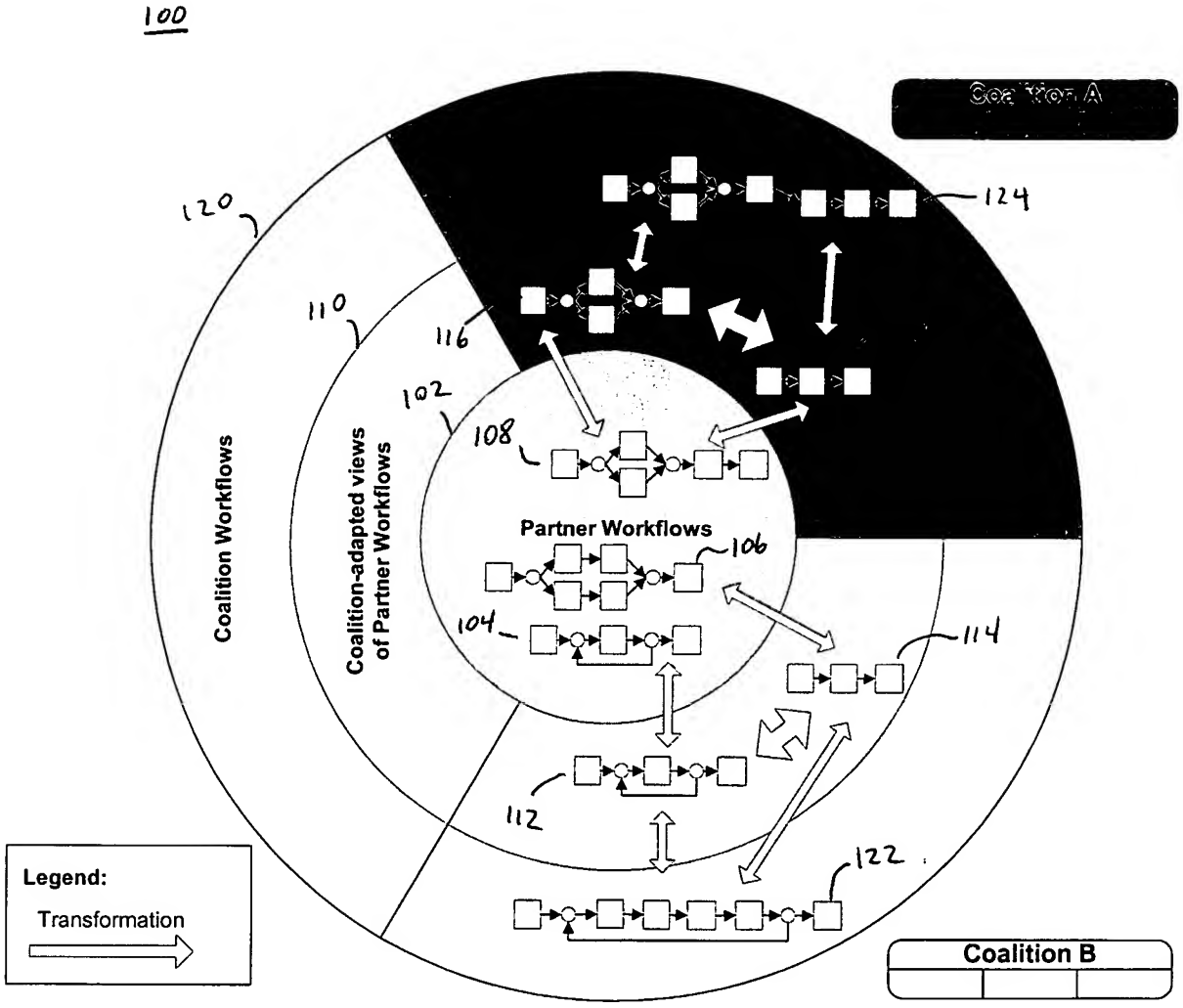

100
Coalition A
120
124
110
116
102
108
Coalition Workflows
Coalition-adapted views of Partner Workflows
Partner Workflows
106
104
114
112
122
Legend:
Transformation
Coalition B

FIG. 1

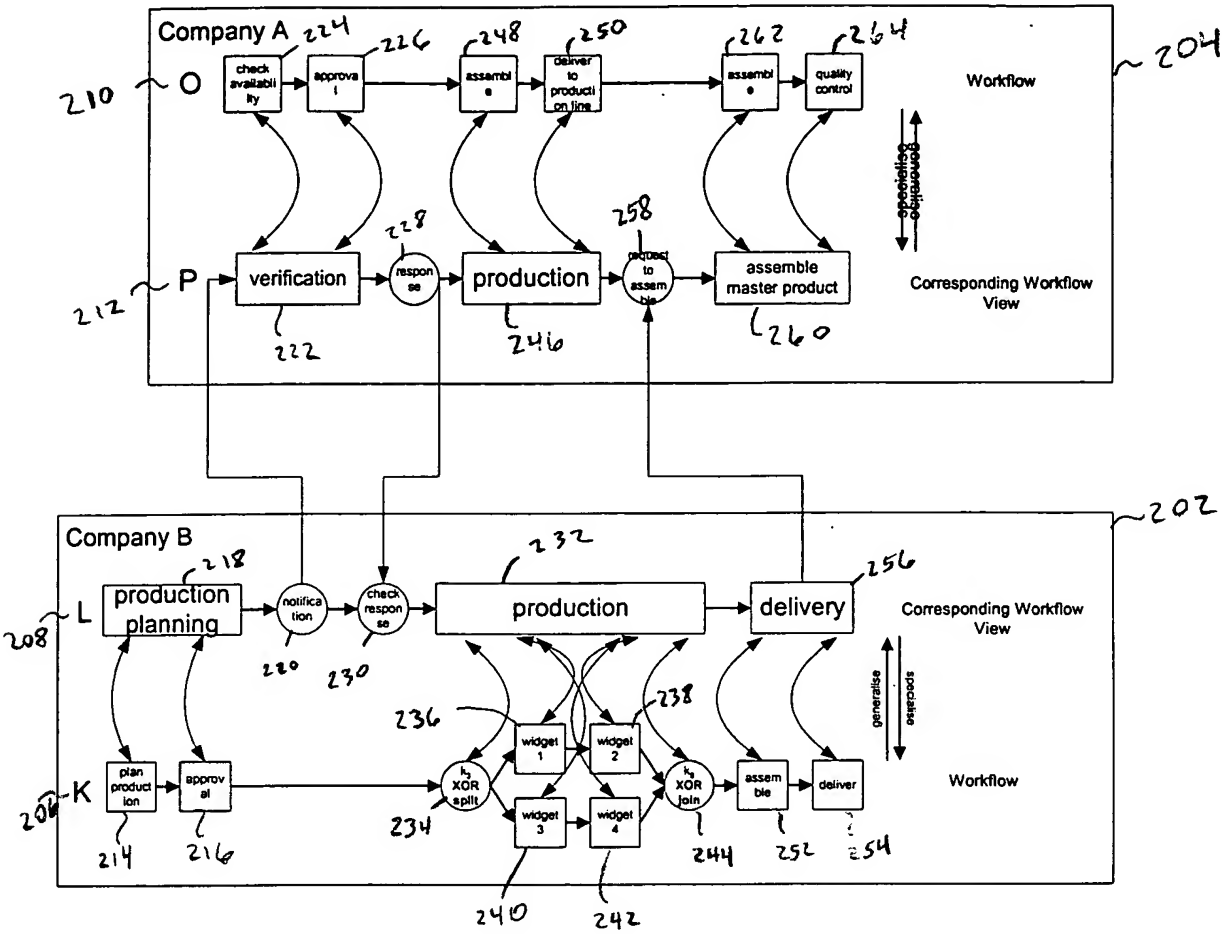

Company A
check availability
approval
assemble
deliver to production line
assemble
quality control
Workflow
specialise
generalise
O
P
verification
response
production
request to assemble
assemble master product
Corresponding Workflow View
Company B
production planning
notification
check response
production
delivery
Corresponding Workflow View
L
K
plan production
approval
XOR split
widget 1
widget 2
widget 3
widget 4
XOR join
assemble
deliver
Workflow
210
212
204
224
226
248
250
262
264
222
228
246
258
260
202
208
206
218
220
230
232
256
214
216
234
236
238
240
242
244
252
254

FIG. 2

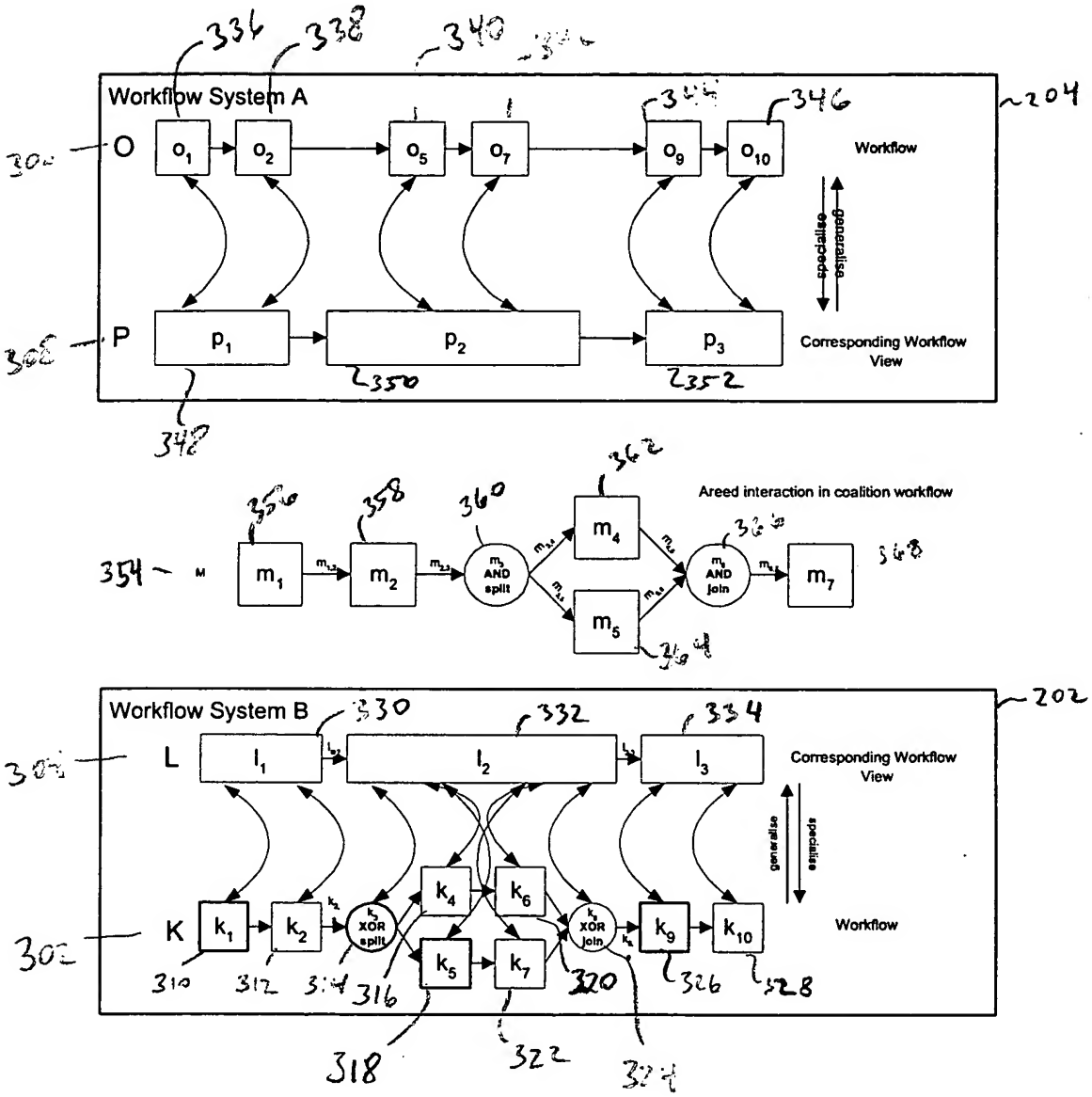

Workflow System A
O
P
Workflow
Corresponding Workflow View
generalise
specialise
Areed interaction in coalition workflow
AND split
AND join
Workflow System B
L
K
XOR split
XOR join
Corresponding Workflow View
Workflow

FIG. 3

400

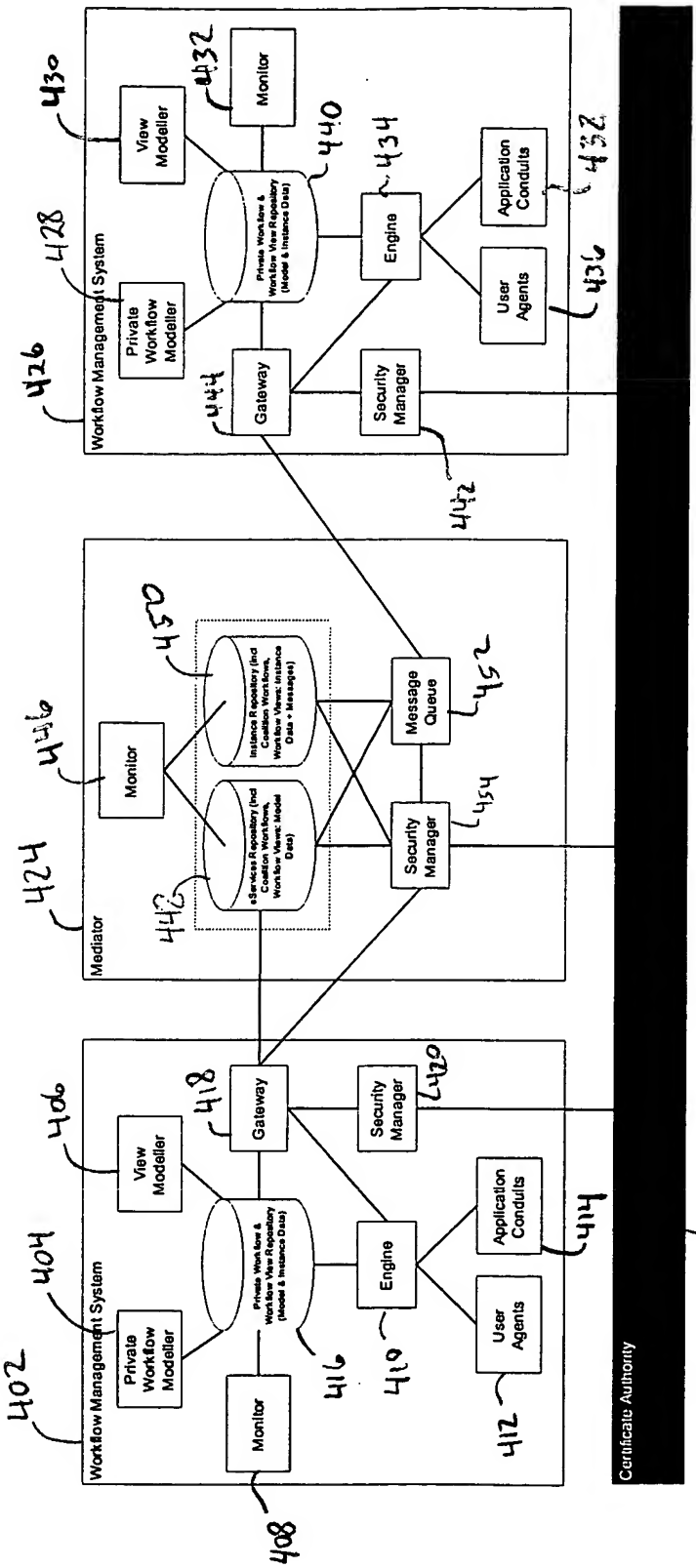

Workflow Management System
Private Workflow Modeller
View Modeller
Monitor
Private Workflow & Workflow View Repository (Model & Instance Data)
Engine
Application Conduits
User Agents
Gateway
Security Manager
Mediator
Monitor
Instance Repository (incl Coalition Workflows, Workflow Views: Instance Data + Messages)
eServices Repository (incl Coalition Workflows, Workflow Views: Model Data)
Message Queue
Security Manager
Workflow Management System
Private Workflow Modeller
View Modeller
Monitor
Private Workflow & Workflow View Repository (Model & Instance Data)
Engine
Application Conduits
User Agents
Gateway
Security Manager
Certificate Authority
402
404
406
408
410
412
414
416
418
420
422
424
426
428
430
432
434
436
438
440
442
444
446
448
450
452
454

FIG. 4

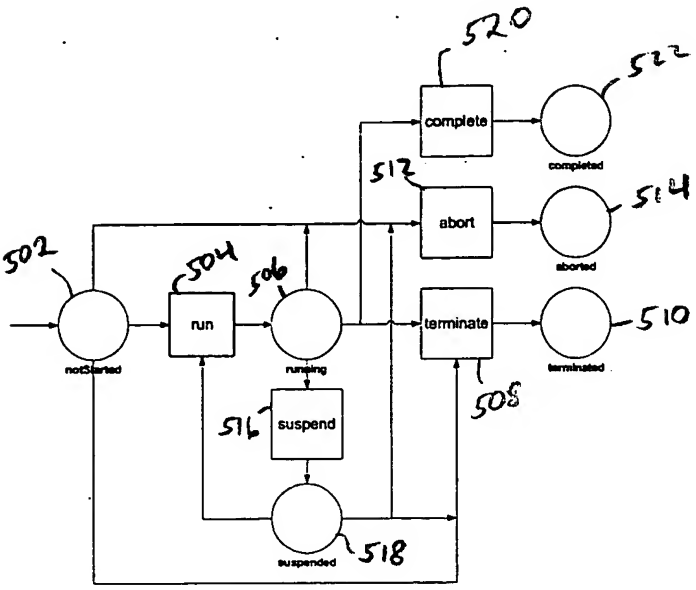

520
522
complete
completed
512
abort
514
aborted
502
504
506
run
terminate
510
notStarted
running
terminated
516
suspend
508
suspended
518

FIG. 5

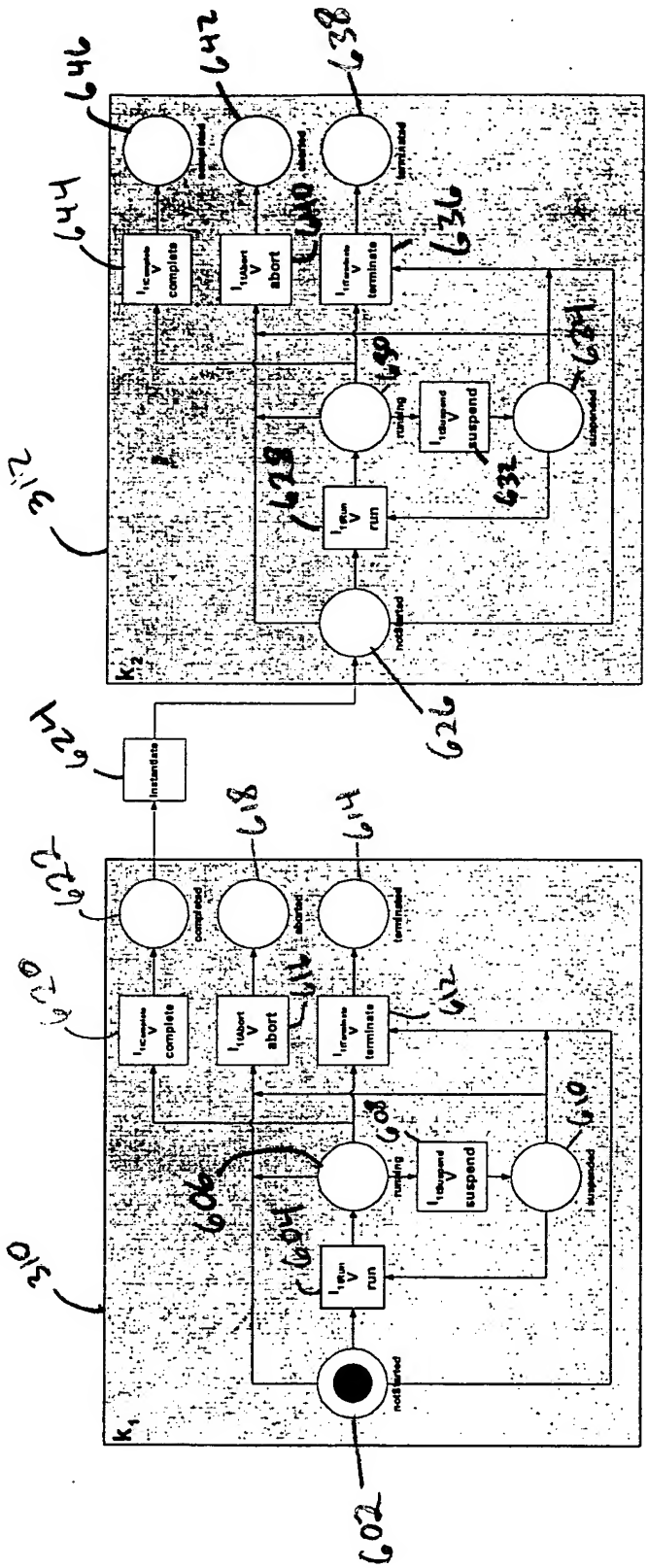

instantiate
complete
abort
terminate
suspend
run
running
suspended
not started
completed
aborted
terminated

FIG. 6

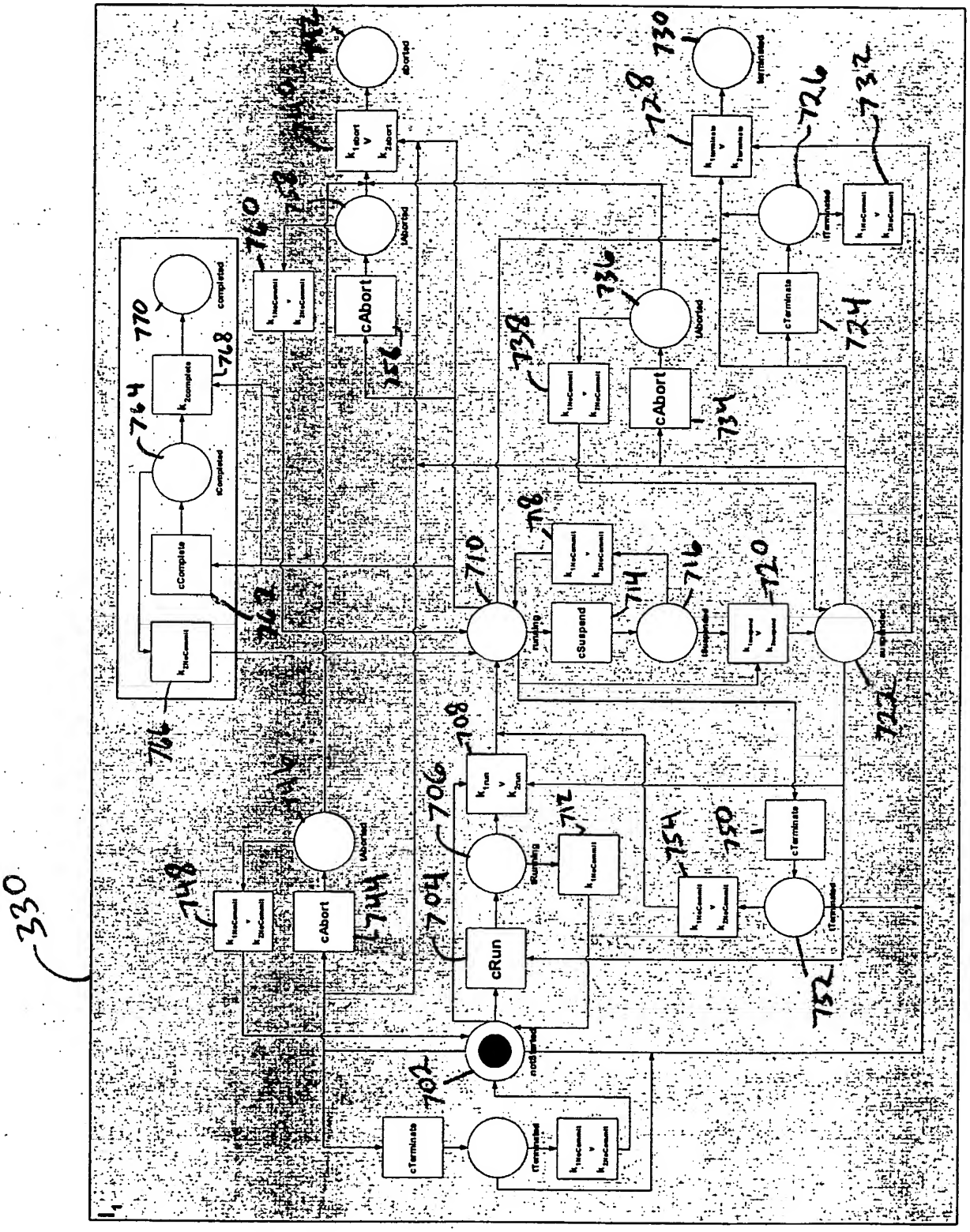

330
702
704
706
708
710
712
714
716
718
720
722
724
726
728
730
732
734
736
738
740
742
744
746
748
750
752
754
760
762
764
766
768
770
cRun
cSuspend
cResume
cTerminate
cAbort
cComplete
running
suspended
resumed
terminated
aborted
completed

FIG. 7

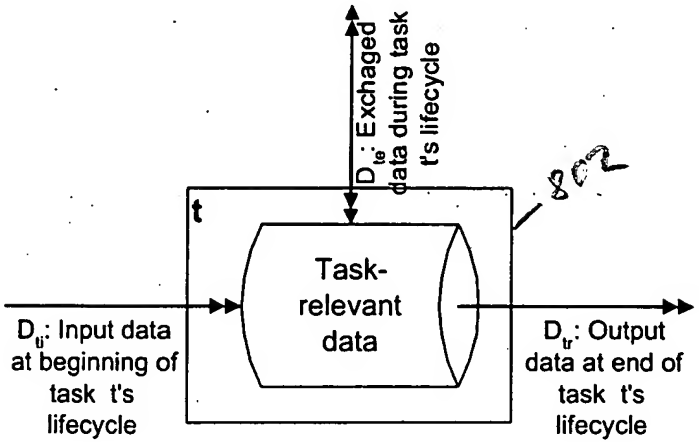

D_{ie}: Exchaged data during task t's lifecycle
t
Task-relevant data
D_{ti}: Input data at beginning of task t's lifecycle
D_{tr}: Output data at end of task t's lifecycle
800

FIG. 8

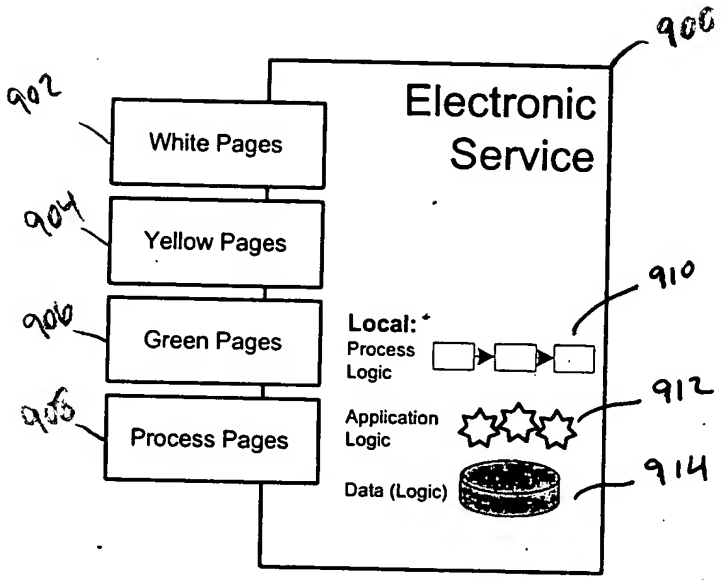

900
902
White Pages
904
Yellow Pages
906
Green Pages
908
Process Pages
Electronic Service
910
Local:
Process Logic
912
Application Logic
914
Data (Logic)

FIG. 9

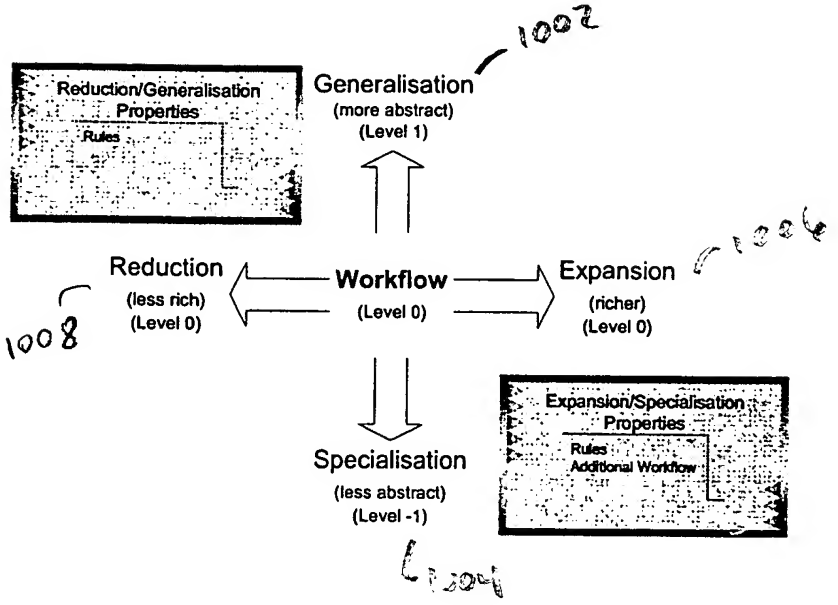

1002
Reduction/Generalisation Properties
Rules
Generalisation
(more abstract)
(Level 1)
Reduction
(less rich)
(Level 0)
1008
Workflow
(Level 0)
Expansion
(richer)
(Level 0)
1006
Specialisation
(less abstract)
(Level -1)
Expansion/Specialisation Properties
Rules
Additional Workflow
1004

FIG. 10

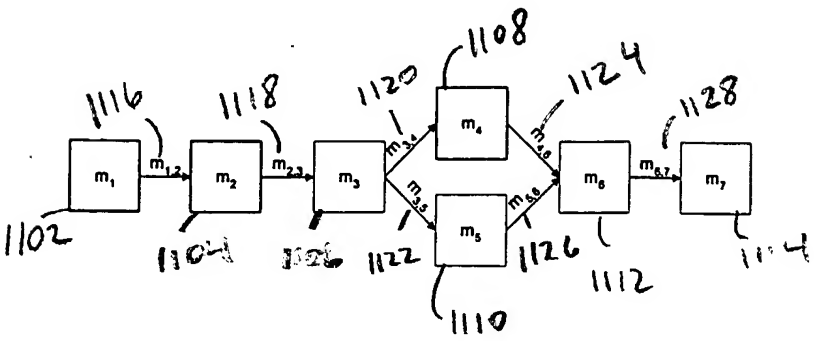

1100
1116
1118
1120
1108
1124
1128
m1
m1,2
m2
m2,3
m3
m3,4
m3,5
m4
m4,6
m5
m5,6
m6
m6,7
m7
1102
1104
1106
1122
1126
1112
1114
1110

FIG. 11

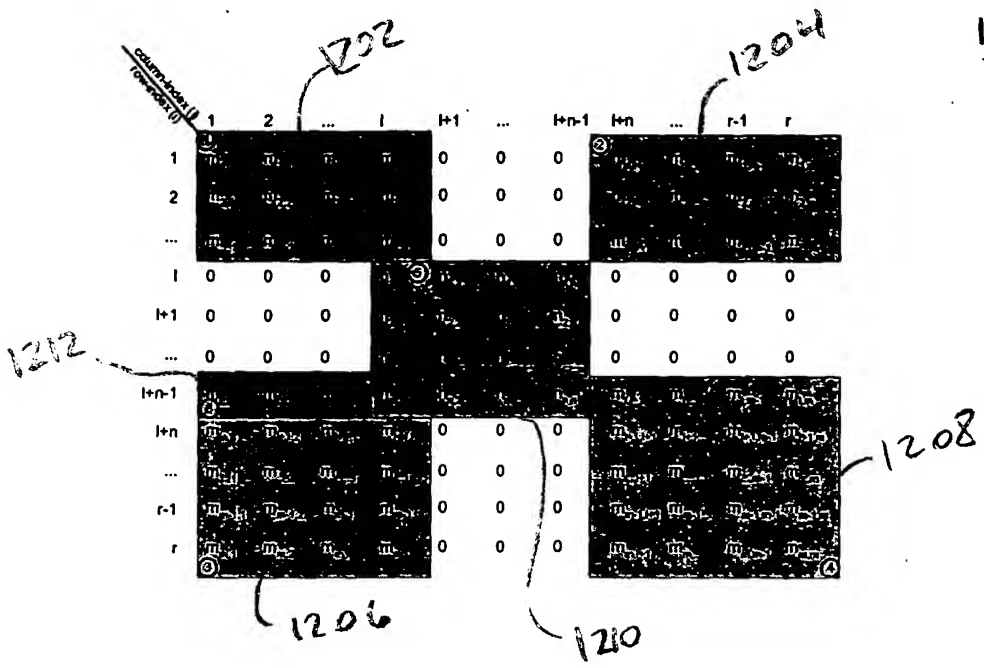

1200
1202
1204
1212
1208
1206
1210
column index (j)
row index (i)
1
2
...
l
l+1
...
l+n-1
l+n
...
r-1
r

FIG. 12

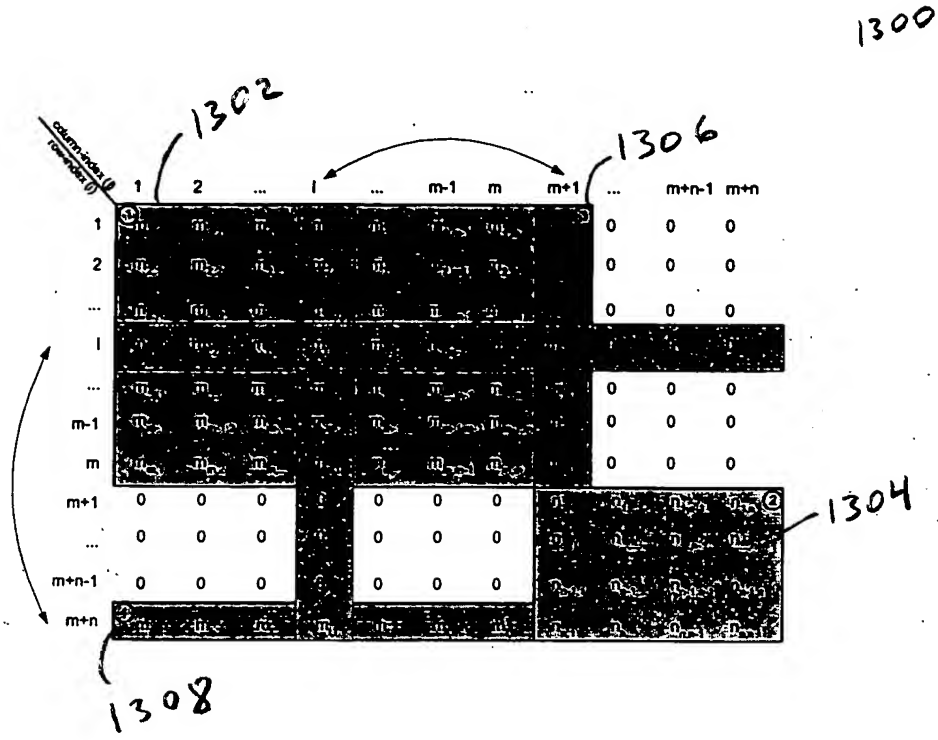

1300
1302
1306
1304
1308
column index (j)
row index (i)
1
2
...
i
...
m-1
m
m+1
...
m+n-1
m+n
0

FIG. 13

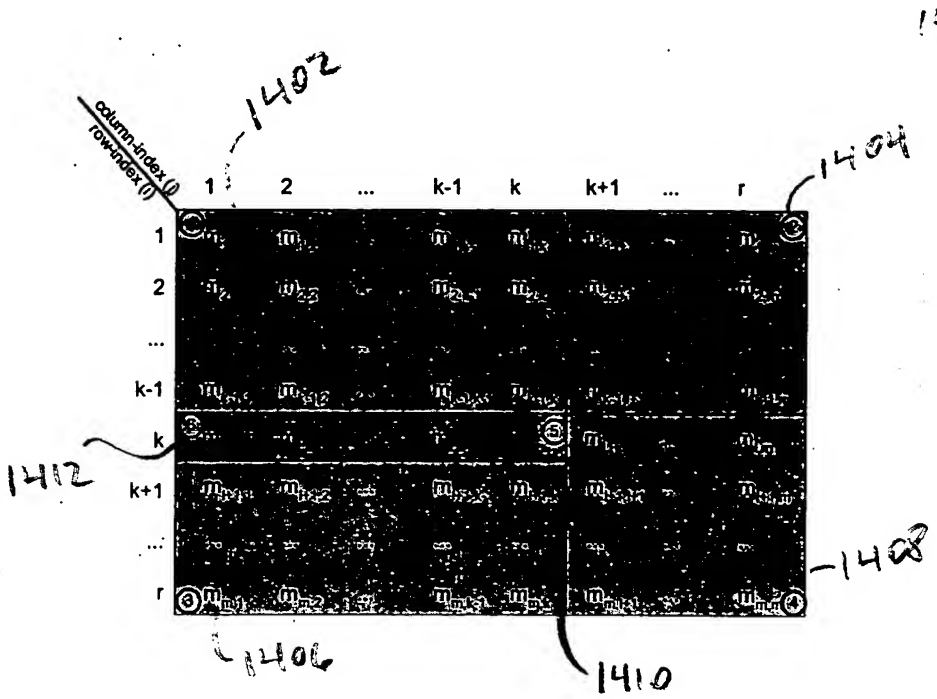

1400
1402
column-index (j)
row-index (i)
1
2
...
k-1
k
k+1
...
r
1404
1412
1408
1406
1410

FIG. 14

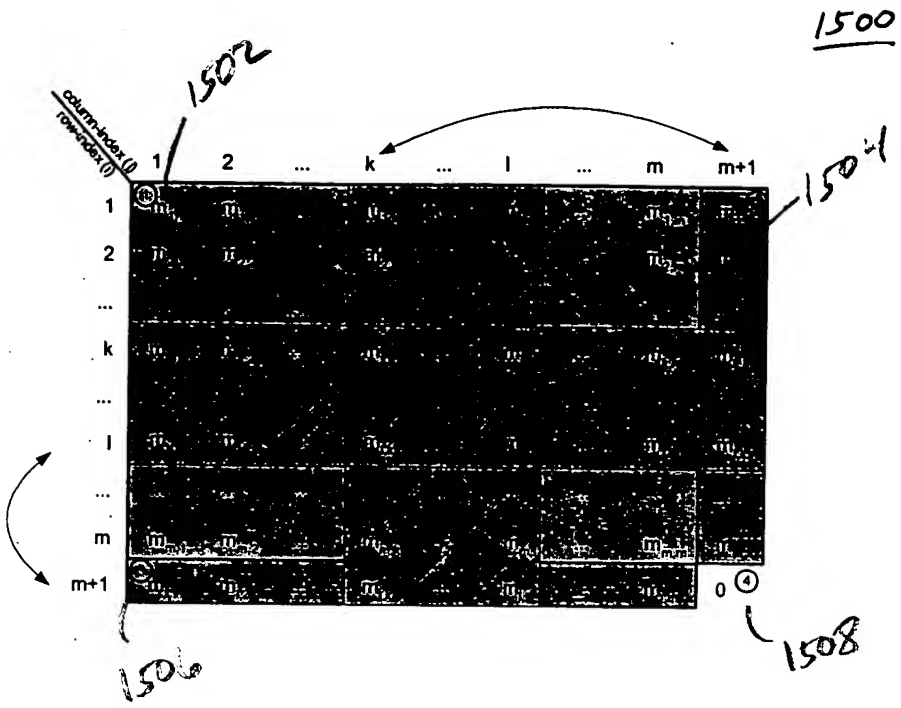


FIG. 15

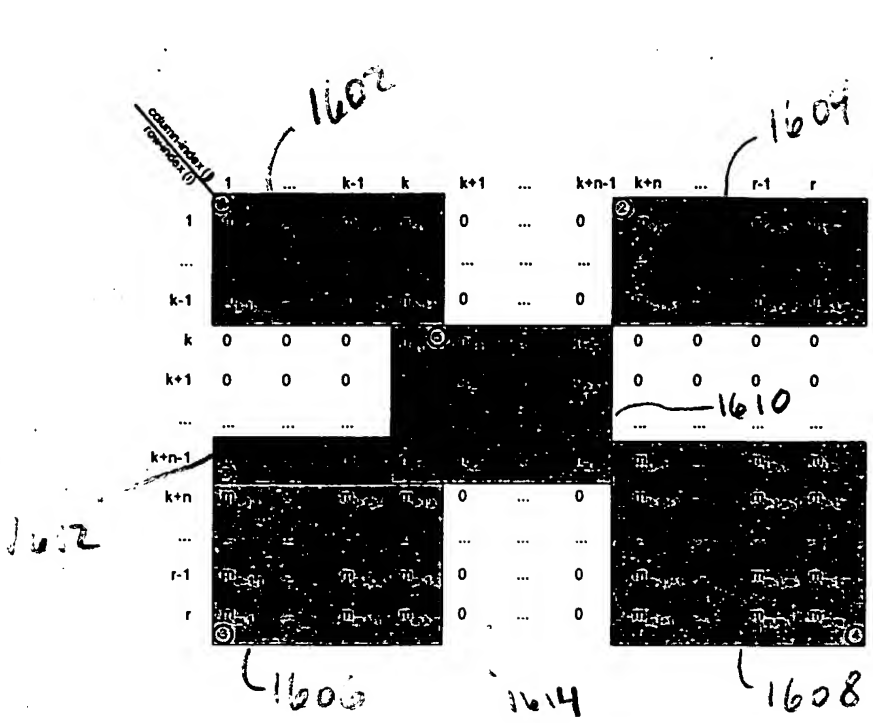

1600
1602
1604
1606
1608
1609
1610
1612
1614
column index (j)
row index (i)
1
...
k-1
k
k+1
...
k+n-1
k+n
...
r-1
r
0

FIG. 16

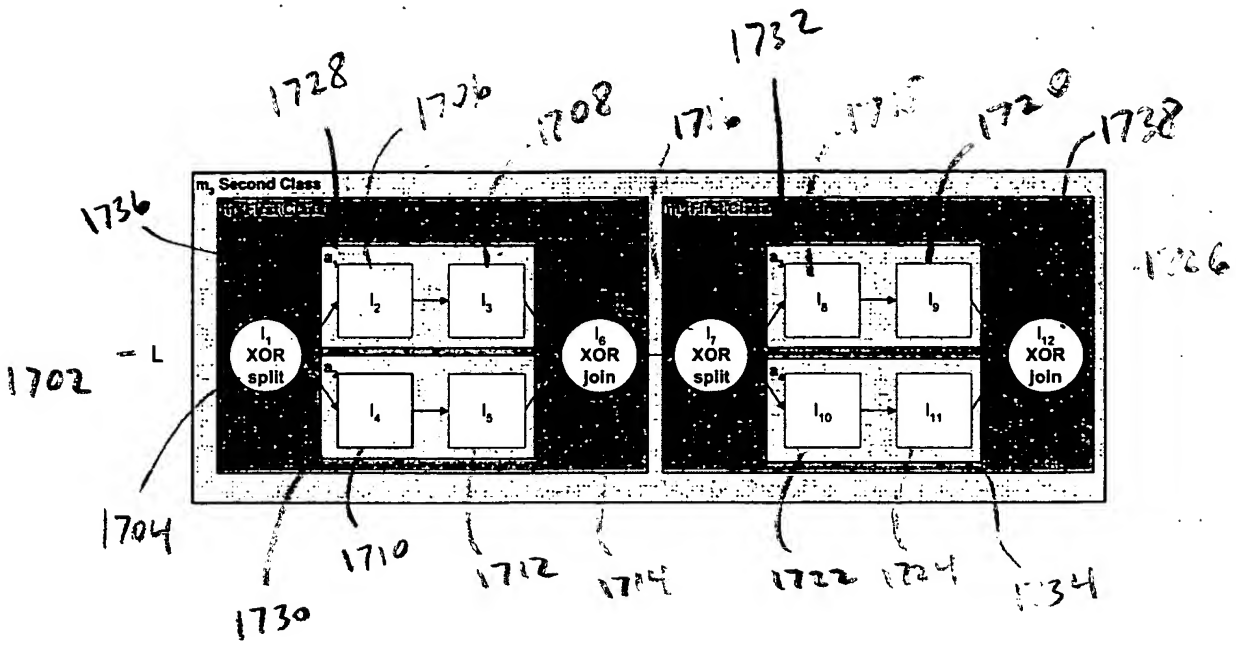

1728
1732
1736
1738
1726
1702
1704
1730
1710
1712
1722
1734
m, Second Class
XOR split
XOR join
XOR split
XOR join

FIG. 17

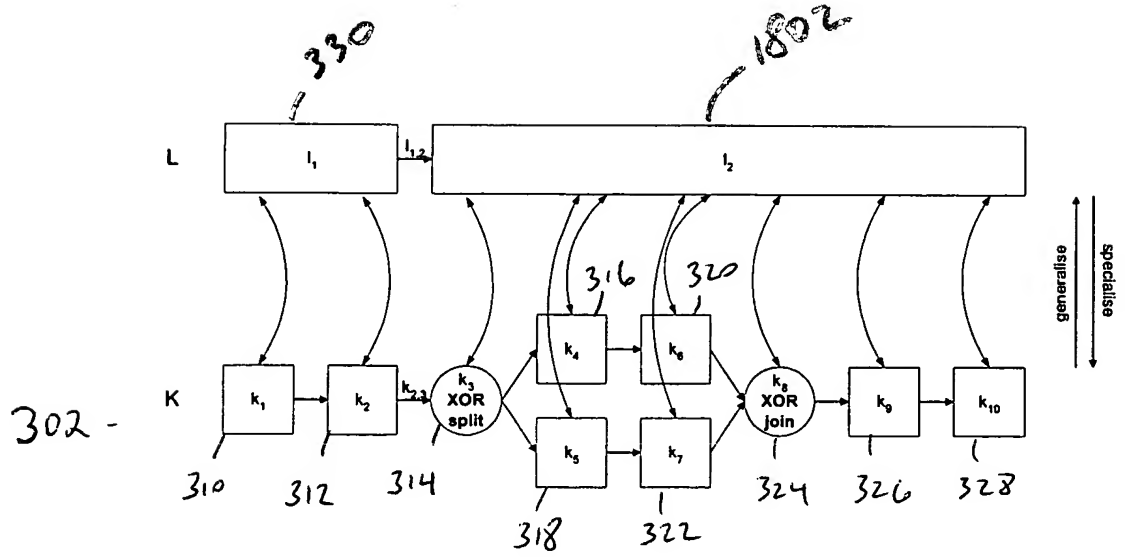

330
1802
L
l_1
l_{12}
l_2
316
320
generalise
specialise
K
k_1
k_2
$k_{2,3}$
k_3 XOR split
k_4
k_6
k_5
k_7
k_8 XOR join
k_9
k_{10}
302
310
312
314
318
322
324
326
328

FIG. 18

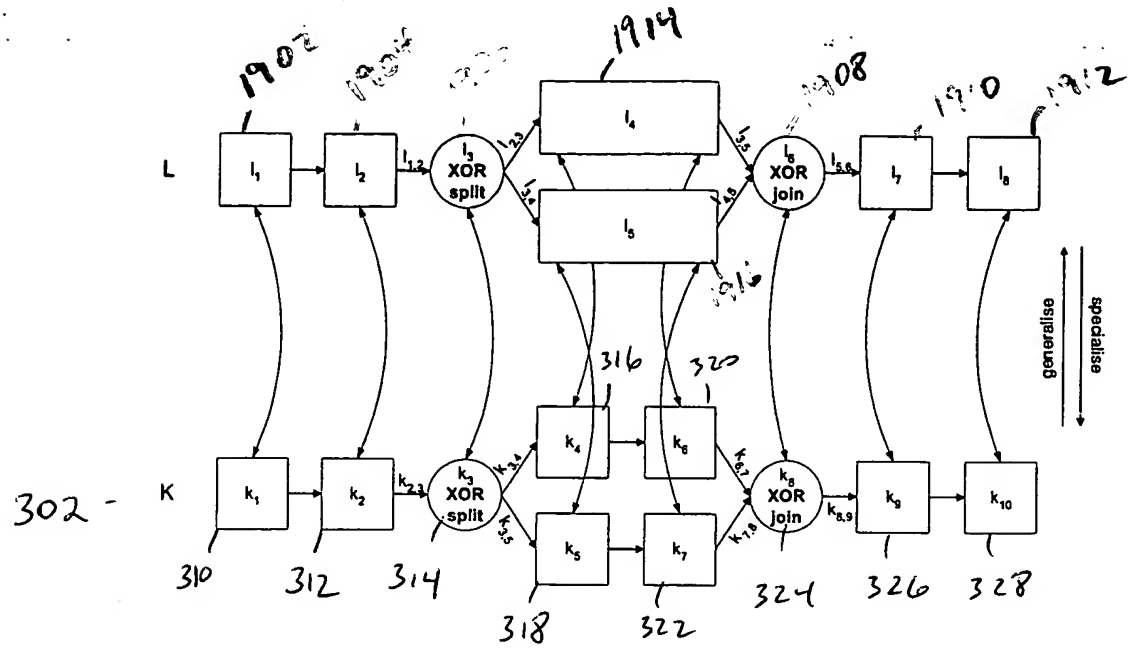
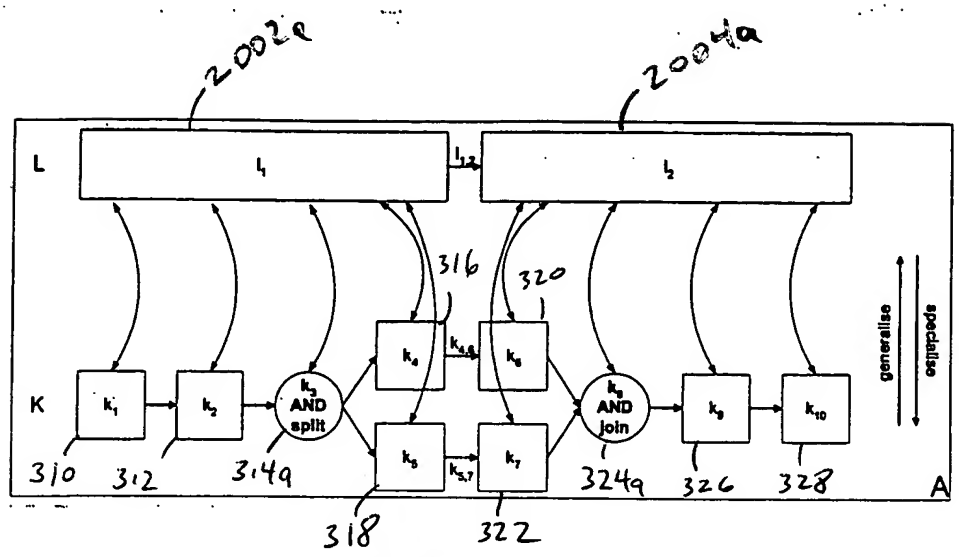

L
K
XOR split
XOR join
XOR split
XOR join
generalise
specialise
302
310
312
314
316
318
320
322
324
326
328

FIG. 19



302a

FIG. 20A

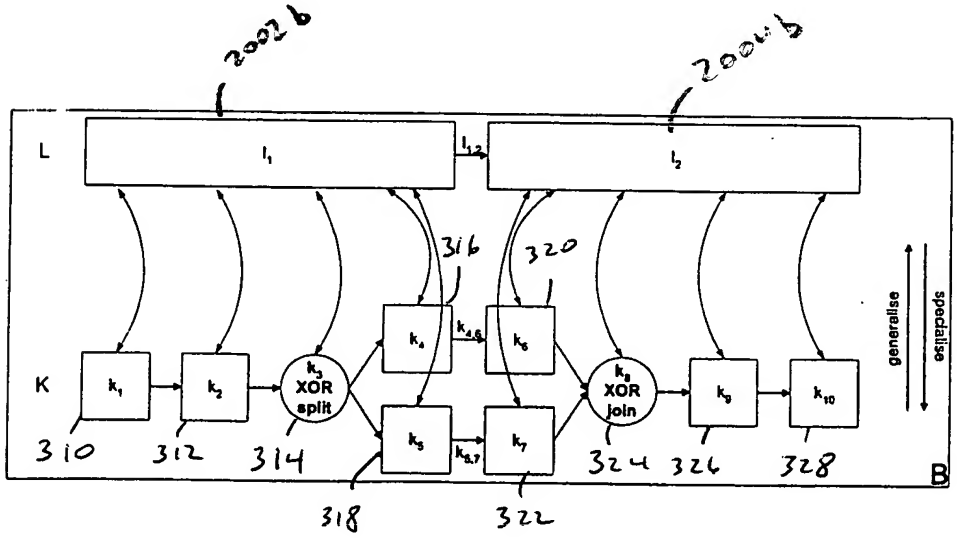


FIG 20B

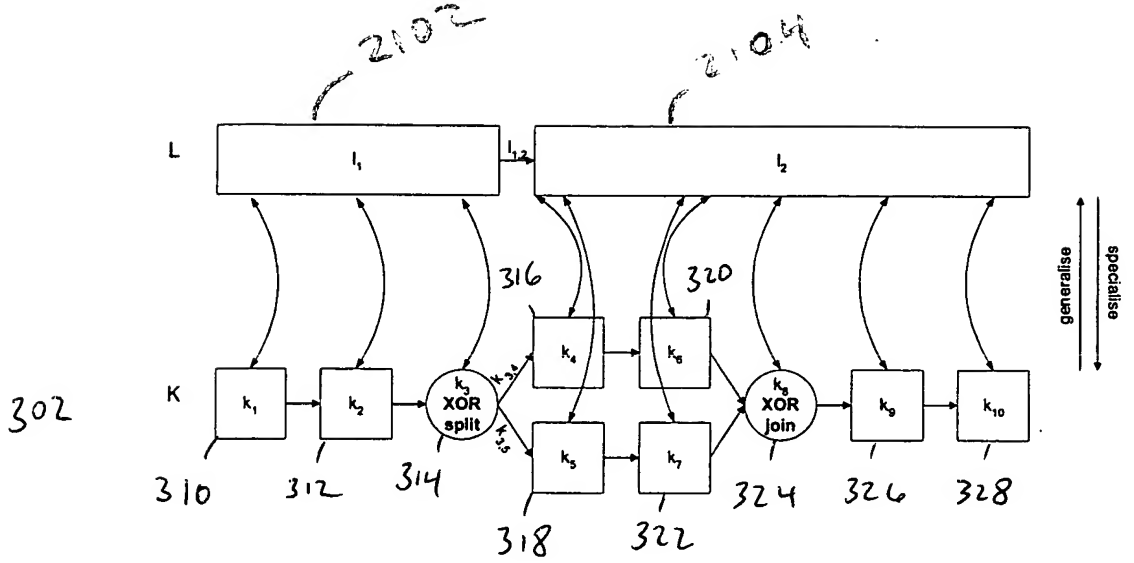

2102
2104
L
l_1
l_{12}
l_2
316
320
generalise
specialise
302
K
k_1
k_2
k_3 XOR split
k_4
k_5
k_6
k_7
k_8 XOR join
k_9
k_{10}
310
312
314
318
322
324
326
328

FIG. 21

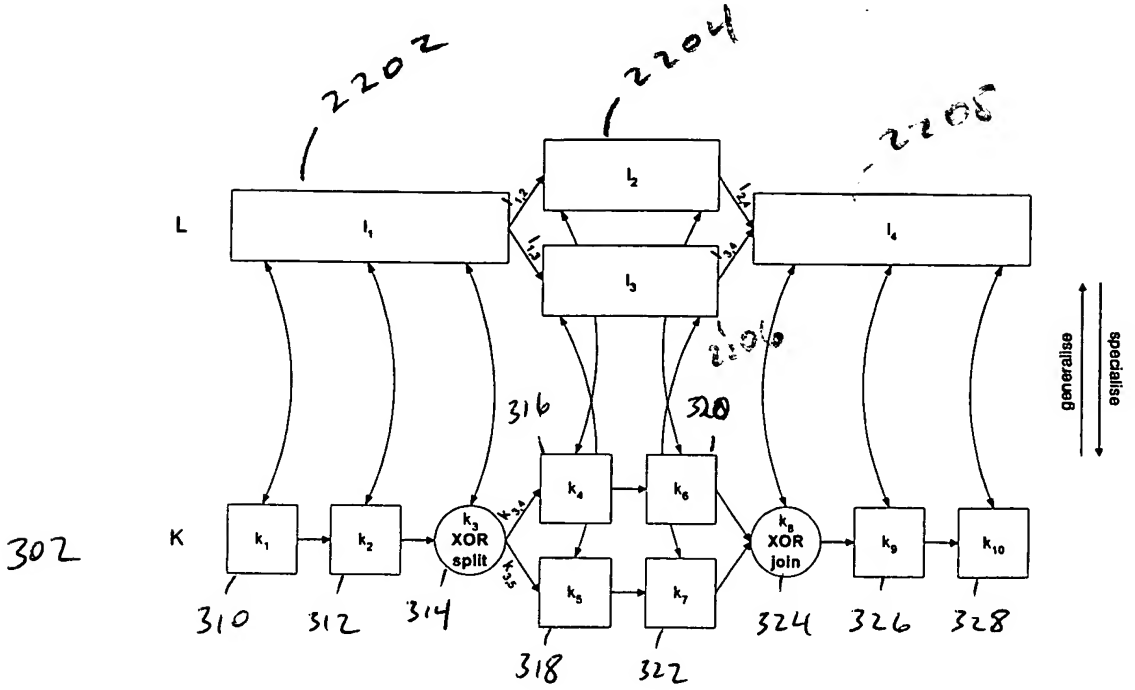

2202
2204
2206
L
K
302
generalise
specialise
XOR split
XOR join
310
312
314
316
318
320
322
324
326
328

FIG. 22

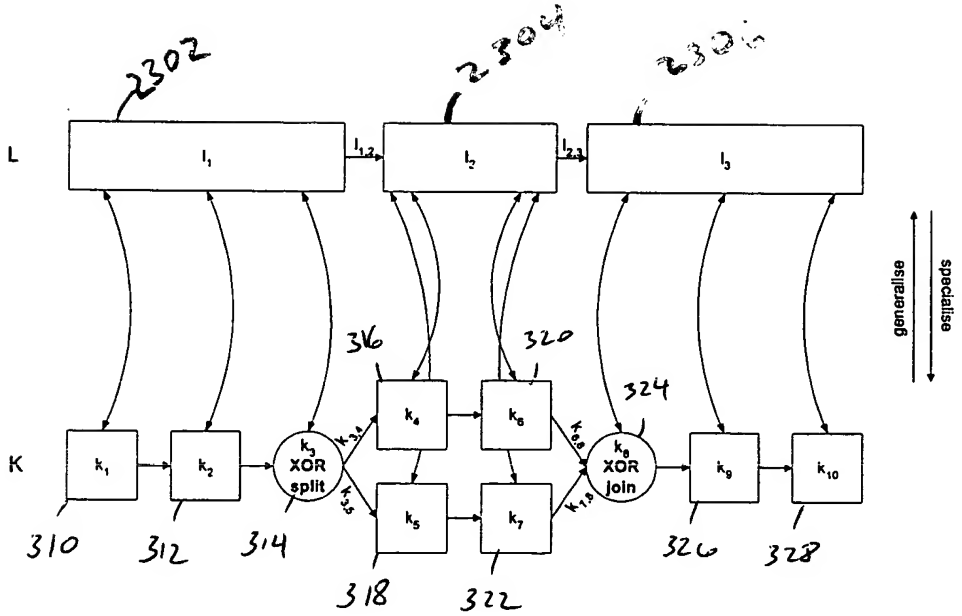

2302
L
K
302
generalise
specialise
XOR split
XOR join
310
312
314
316
318
320
322
324
326
328

FIG. 23

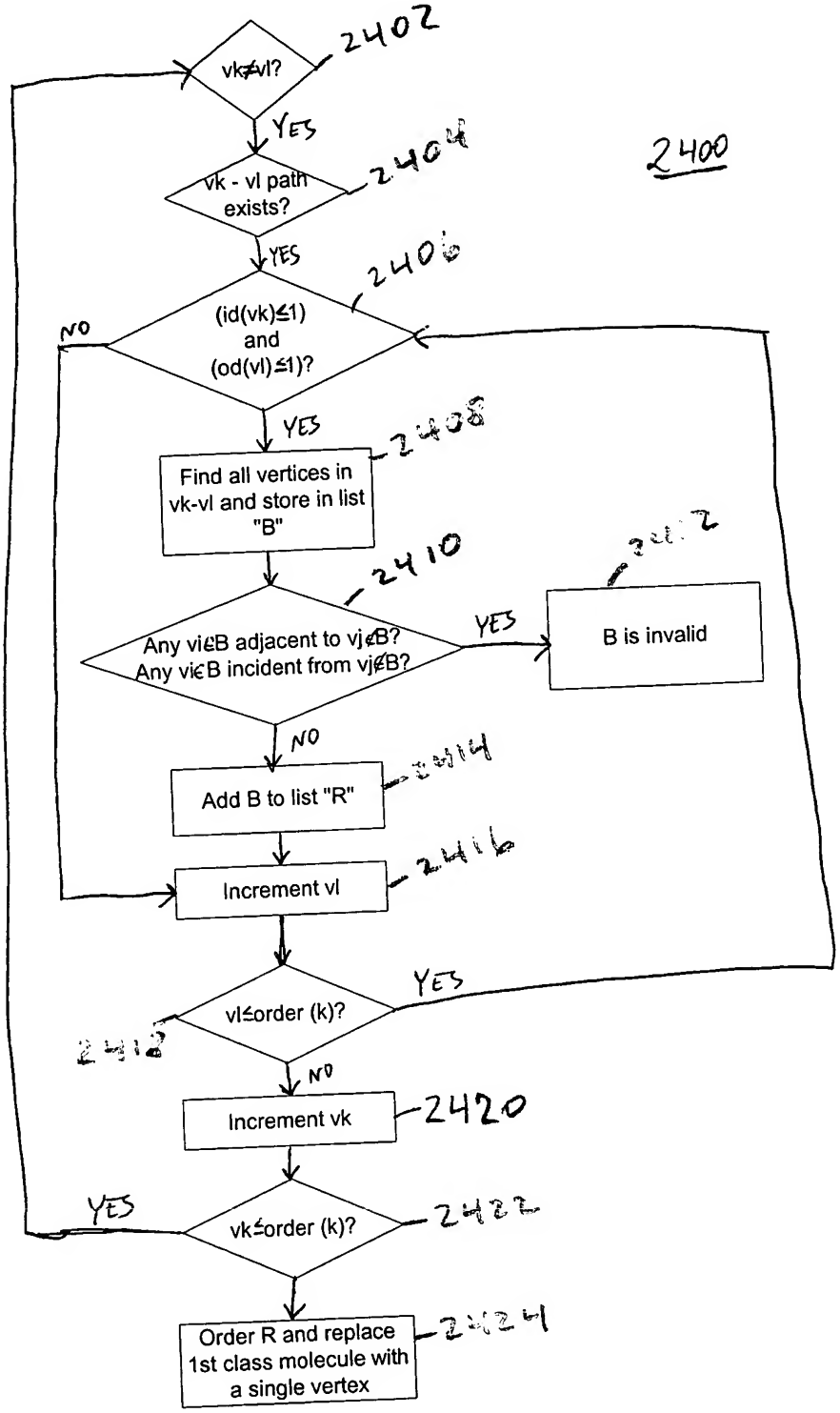

2400
vk≠vl?
2402
YES
vk - vl path exists?
2404
YES
(id(vk)≤1) and (od(vl)≤1)?
2406
NO
YES
Find all vertices in vk-vl and store in list "B"
2408
Any vi∈B adjacent to vj∉B? Any vi∈B incident from vj∉B?
2410
YES
B is invalid
NO
Add B to list "R"
Increment vl
2416
vl≤order (k)?
YES
NO
Increment vk
2420
vk≤order (k)?
YES
Order R and replace 1st class molecule with a single vertex

FIG. 24

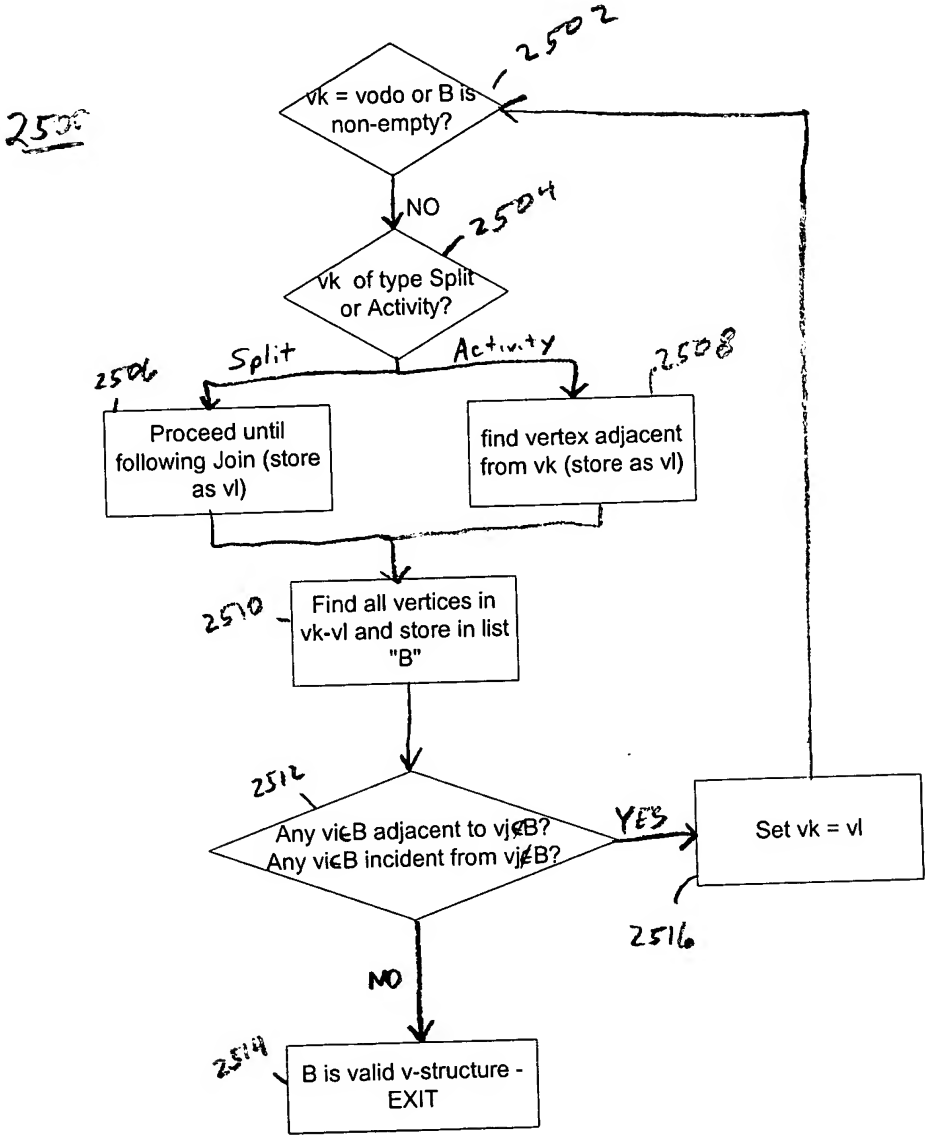

2500
2502
vk = vodo or B is non-empty?
NO
2504
vk of type Split or Activity?
Split
Activity
2506
Proceed until following Join (store as vl)
2508
find vertex adjacent from vk (store as vl)
2510
Find all vertices in vk-vl and store in list "B"
2512
Any vi∈B adjacent to vj∉B?
Any vi∈B incident from vj∉B?
YES
Set vk = vl
2516
NO
2514
B is valid v-structure - EXIT

FIG. 25

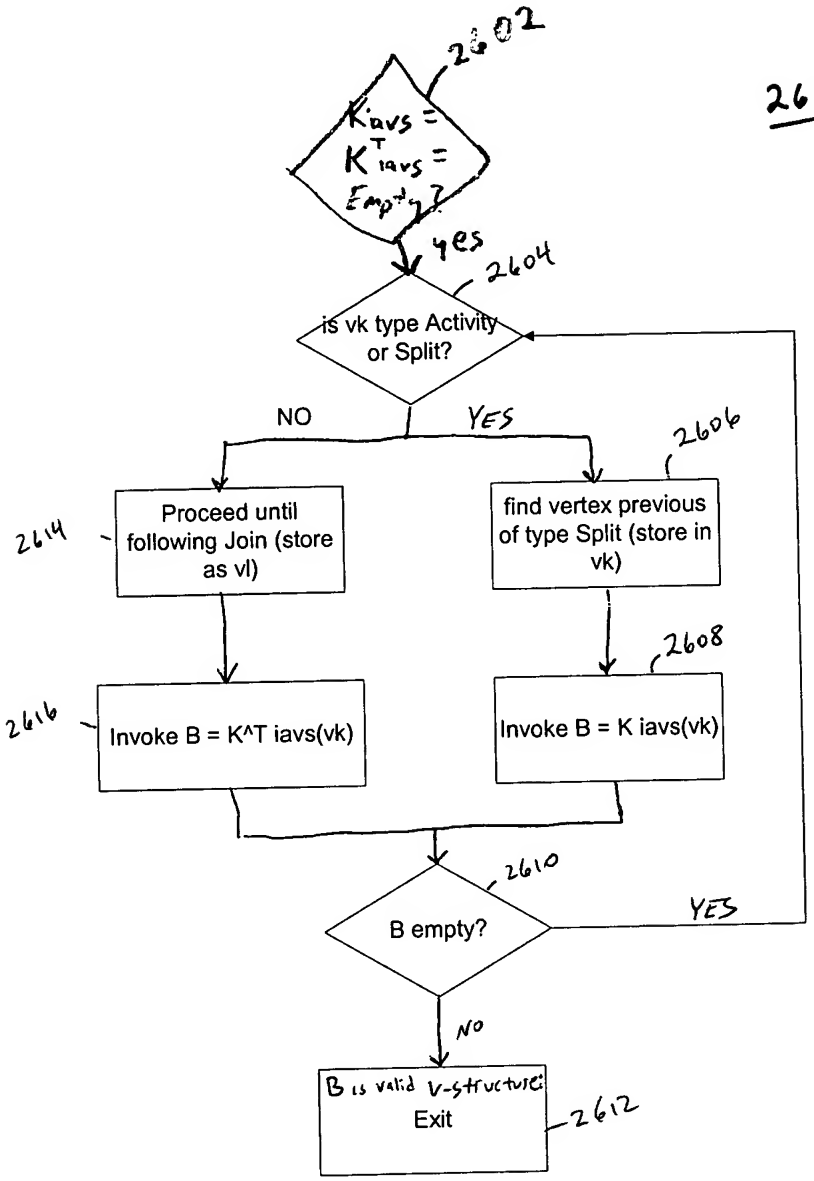

2600
2602
K iavs = K^T iavs = Empty?
yes
2604
is vk type Activity or Split?
NO
YES
2606
find vertex previous of type Split (store in vk)
2614
Proceed until following Join (store as vl)
2608
Invoke B = K iavs(vk)
2616
Invoke B = K^T iavs(vk)
2610
B empty?
YES
NO
B is valid v-structure
Exit
2612

FIG. 26

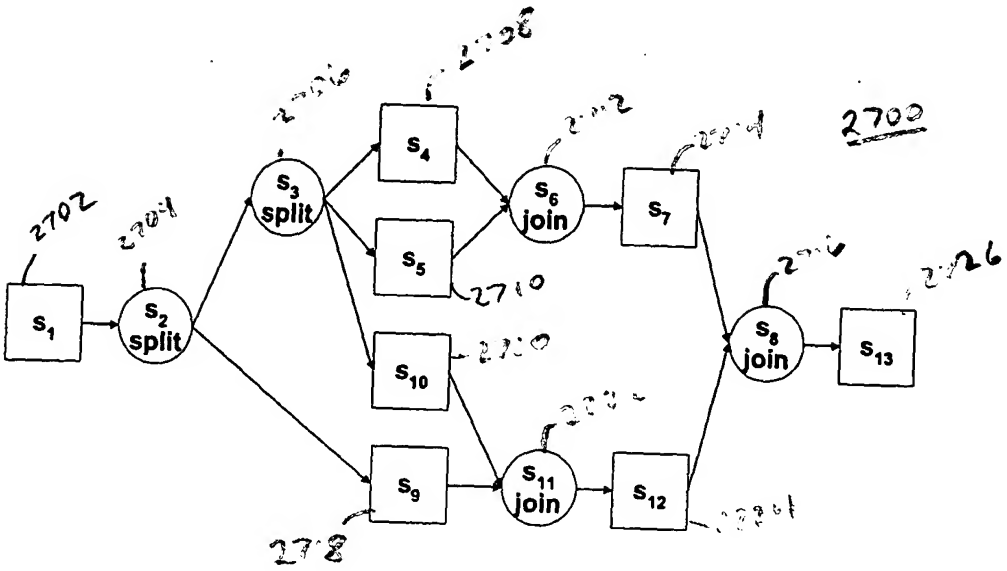


FIG. 27A

v_k	$S\,\mathrm{iavs}_e(v_k)$
s_1	$\{s_1,s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_2	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_3	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_4	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_5	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_6	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_7	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_8	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_9	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_{10}	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_{11}	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_{12}	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12}\}$
s_{13}	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{11},s_{12},s_{13}\}$

FIG. 27B

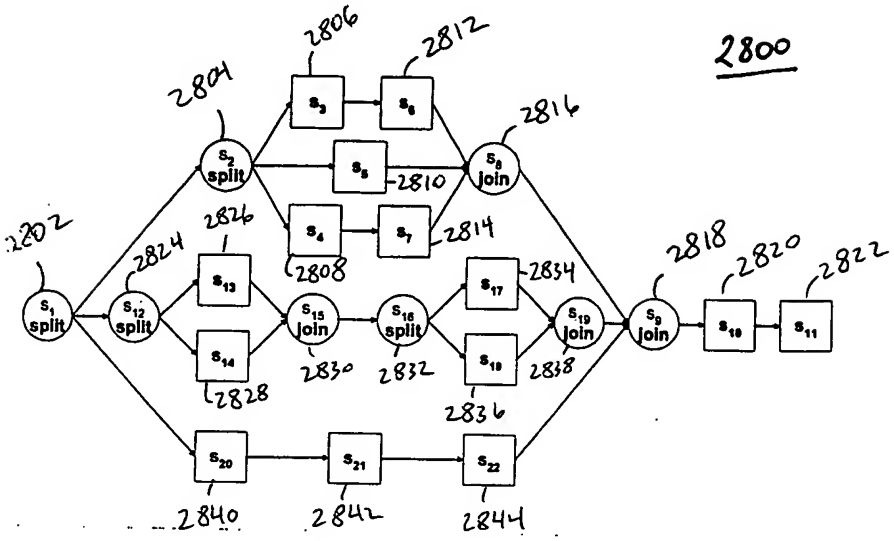


FIG. 28A

v_k	$S\,\text{iavs}_e(v_k)$
s_1	$\{s_1,s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{12},s_{13},s_{14},s_{15},s_{16},s_{17},s_{18},s_{19},s_{20},s_{21},s_{22}\}$
s_2	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8\}$
s_3	$\{s_3,s_6\}$
s_4	$\{s_4,s_7\}$
s_5	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8\}$
s_6	$\{s_3,s_6\}$
s_7	$\{s_4,s_7\}$
s_8	$\{s_2,s_3,s_4,s_5,s_6,s_7,s_8\}$
s_9	$\{s_1,s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{12},s_{13},s_{14},s_{15},s_{16},s_{17},s_{18},s_{19},s_{20},s_{21},s_{22}\}$
s_{10}	$\{s_1,s_2,s_3,s_4,s_5,s_6,s_7,s_8,s_9,s_{10},s_{12},s_{13},s_{14},s_{15},s_{16},s_{17},s_{18},s_{19},s_{20},s_{21},s_{22}\}$, $\{s_{10},s_{11}\}$
s_{11}	$\{s_{10},s_{11}\}$
s_{12}	$\{s_{12},s_{13},s_{14},s_{15}\}$
s_{13}	$\{s_{12},s_{13},s_{14},s_{15}\}$
s_{14}	$\{s_{12},s_{13},s_{14},s_{15}\}$
s_{15}	$\{s_{12},s_{13},s_{14},s_{15}\}$
s_{16}	$\{s_{16},s_{17},s_{18},s_{19}\}$
s_{17}	$\{s_{16},s_{17},s_{18},s_{19}\}$
s_{18}	$\{s_{16},s_{17},s_{18},s_{19}\}$
s_{19}	$\{s_{16},s_{17},s_{18},s_{19}\}$
s_{20}	$\{s_{20},s_{21}\}$
s_{21}	$\{s_{20},s_{21}\}$, $\{s_{21},s_{22}\}$
s_{22}	$\{s_{21},s_{22}\}$

FIG. 28B

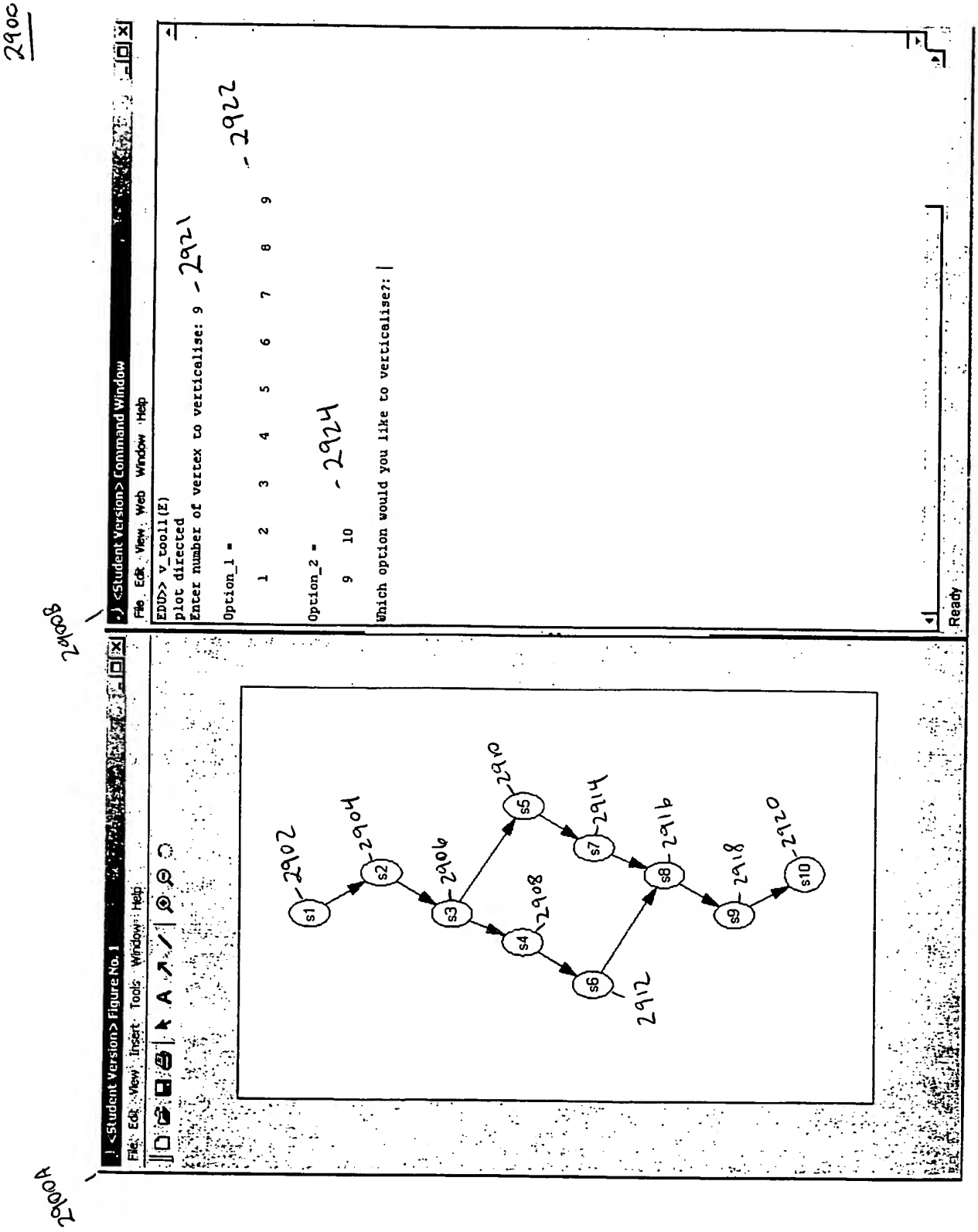

2900
2900A
2900B
<Student Version> Figure No. 1
File Edit View Insert Tools Window Help
<Student Version> Command Window
File Edit View Web Window Help
EDU>> v_tool1(E)
plot directed
Enter number of vertex to verticalise: 9
Option_1 =
1 2 3 4 5 6 7 8 9
Option_2 =
9 10
Which option would you like to verticalise?:
Ready
2902
2904
2906
2908
2910
2912
2914
2916
2918
2920
2921
2922
2924
s1
s2
s3
s4
s5
s6
s7
s8
s9
s10

FIG. 29

3000

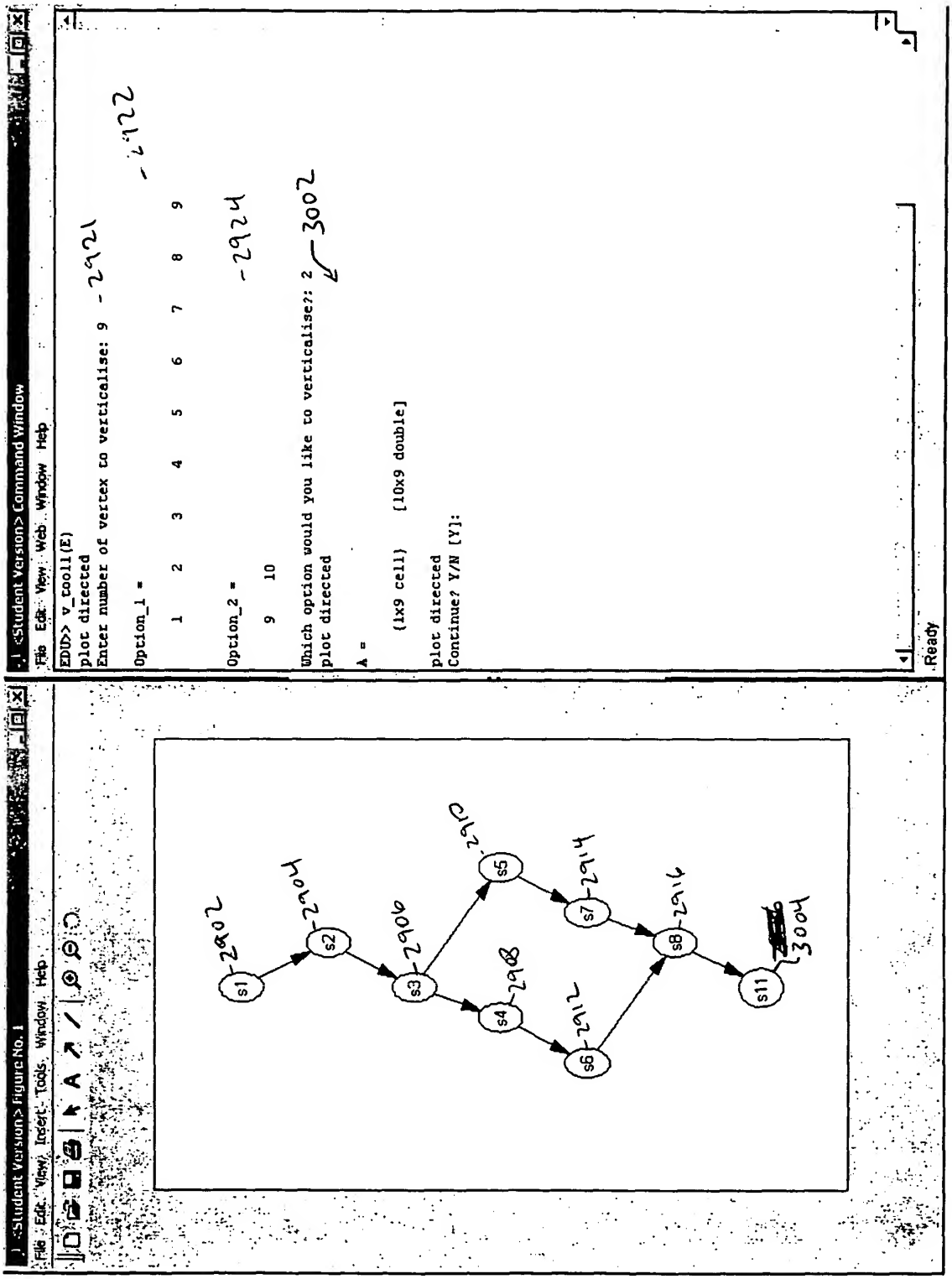

Student Version> Figure No. 1
File Edit View Insert Tools Window Help
s1
s2
s3
s4
s5
s6
s7
s8
s11
Student Version> Command Window
File Edit View Web Window Help
EDU>> v_tool1(E)
plot directed
Enter number of vertex to verticalise: 9
Option_1 =
1 2 3 4 5 6 7 8 9
Option_2 =
9 10
Which option would you like to verticalise?: 2
plot directed
A =
(1x9 cell) [10x9 double]
plot directed
Continue? Y/N [Y]:
Ready

FIG. 30

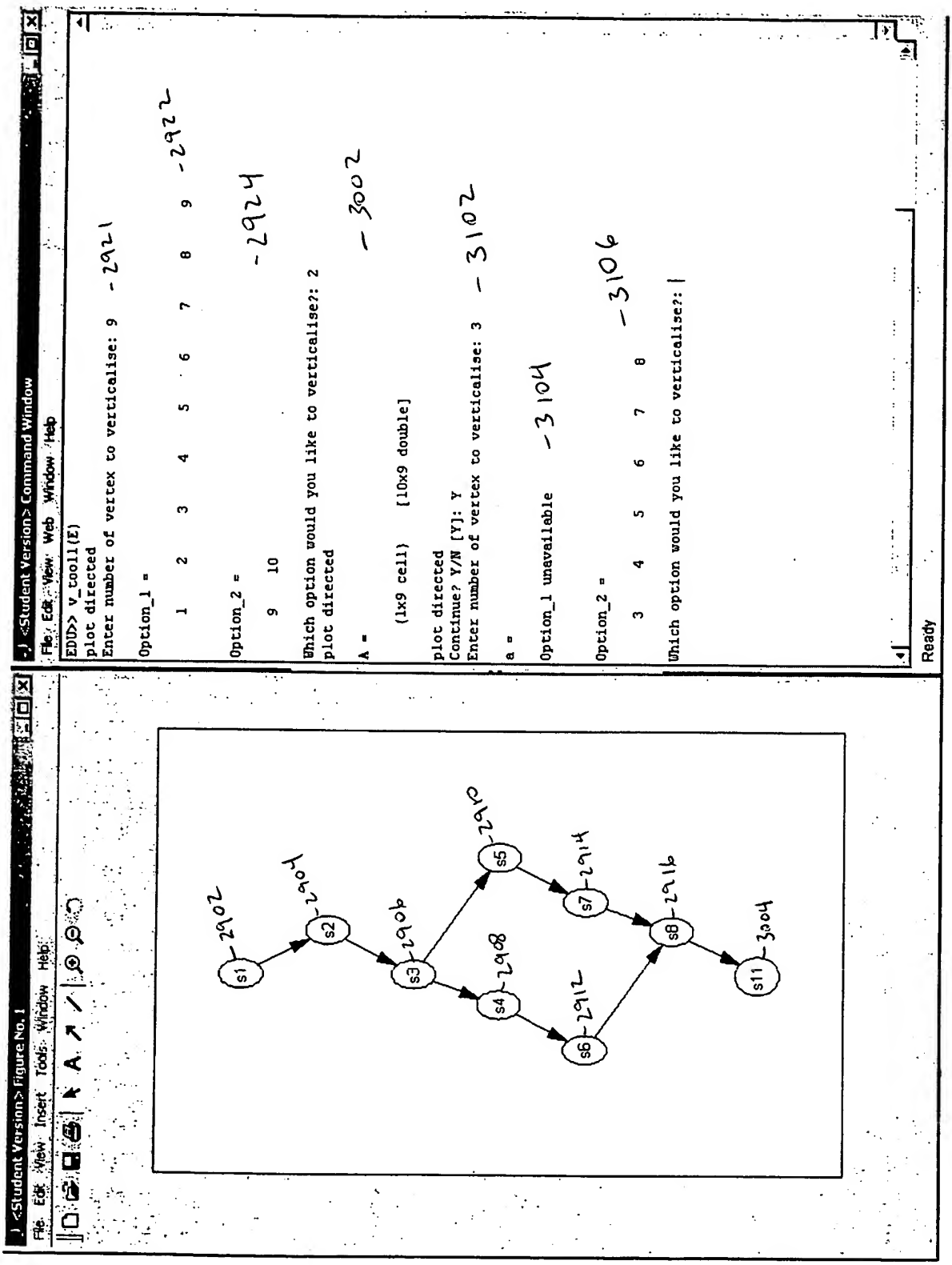

3109
<Student Version> Figure No. 1
File Edit View Insert Tools Window Help
s1
s2
s3
s4
s5
s6
s7
s8
s11
2902
2904
2906
2908
2910
2912
2914
2916
3004
<Student Version> Command Window
File Edit View Web Window Help
EDU>> v_tool1(E)
plot directed
Enter number of vertex to verticalise: 9
Option_1 =
1 2 3 4 5 6 7 8 9
Option_2 =
9 10
Which option would you like to verticalise?: 2
plot directed
A =
(1x9 cell) (10x9 double)
plot directed
Continue? Y/N [Y]: Y
Enter number of vertex to verticalise: 3
a =
Option_1 unavailable
Option_2 =
3 4 5 6 7 8
Which option would you like to verticalise?:
Ready
2921
2922
2924
3002
3102
3104
3106

FIG. 31

3200

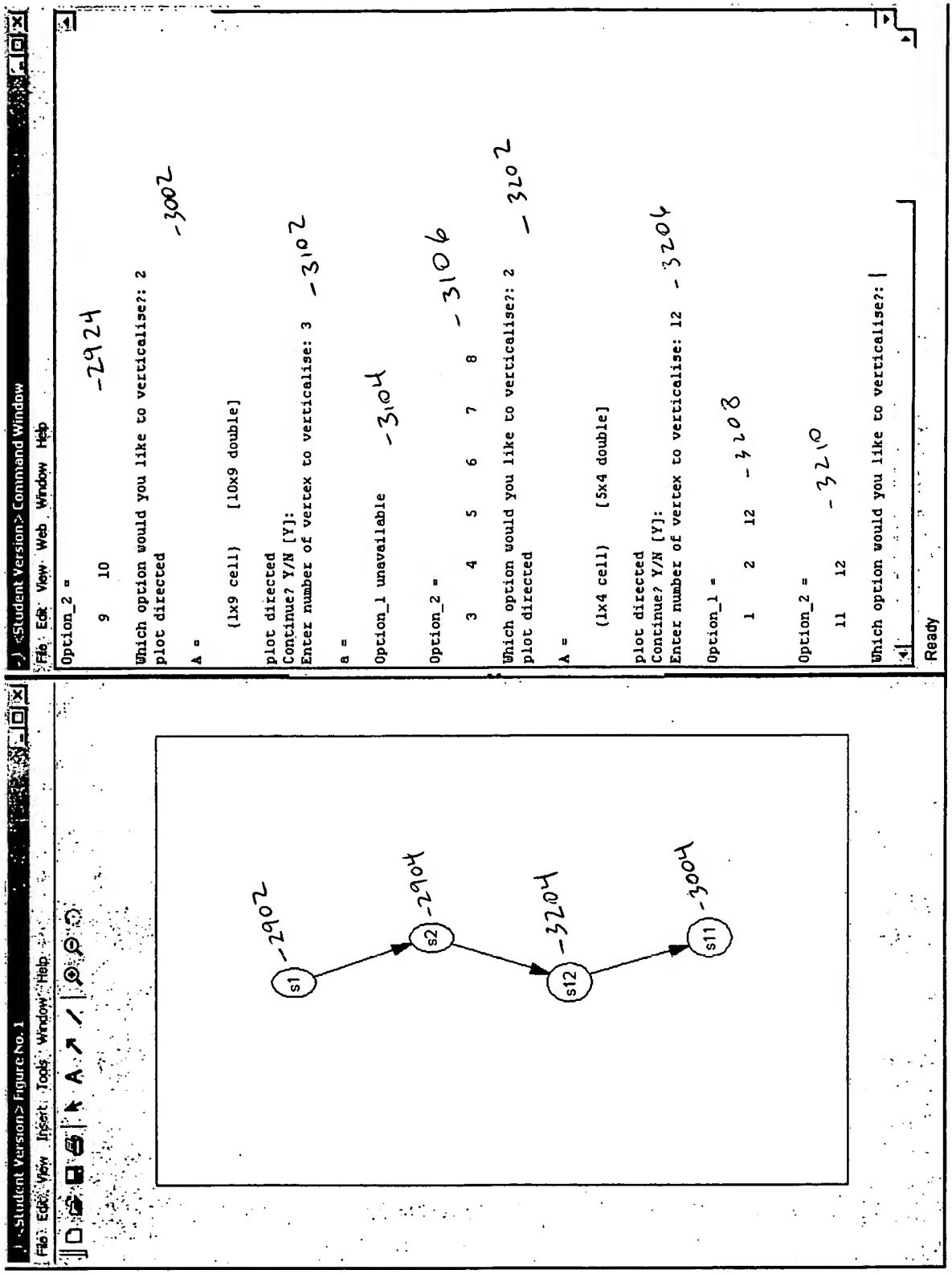

Student Version> Figure No. 1
File Edit View Insert Tools Window Help
s1
s2
s12
s11
-2902
-2904
-3204
-3004
Student Version> Command Window
File Edit View Web Window Help
Option_2 =
9 10
-2924
Which option would you like to verticalise?: 2
plot directed
-3002
A =
(1x9 cell) [10x9 double]
plot directed
Continue? Y/N [Y]:
Enter number of vertex to verticalise: 3
-3102
a =
Option_1 unavailable
-3104
Option_2 =
3 4 5 6 7 8
-3106
Which option would you like to verticalise?: 2
-3202
plot directed
A =
(1x4 cell) [5x4 double]
plot directed
Continue? Y/N [Y]:
Enter number of vertex to verticalise: 12
-3204
Option_1 =
1 2 12
-4208
Option_2 =
11 12
-3210
Which option would you like to verticalise?: 1
Ready

FIG. 32

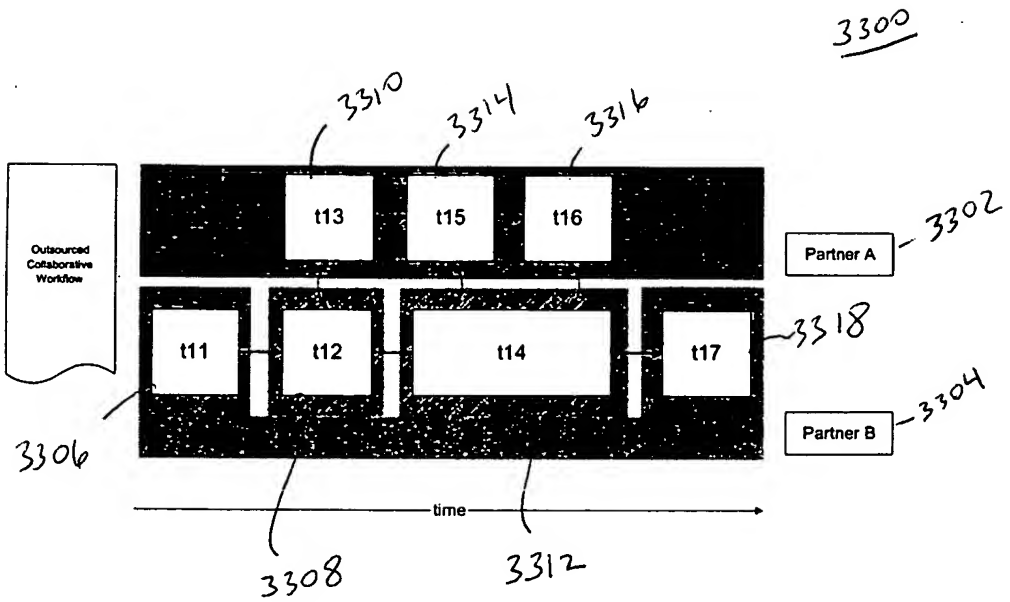

3300
3310
3314
3316
t13
t15
t16
Outsourced Collaborative Workflow
Partner A
3302
t11
t12
t14
t17
3318
Partner B
3304
3306
time
3308
3312

FIG. 33

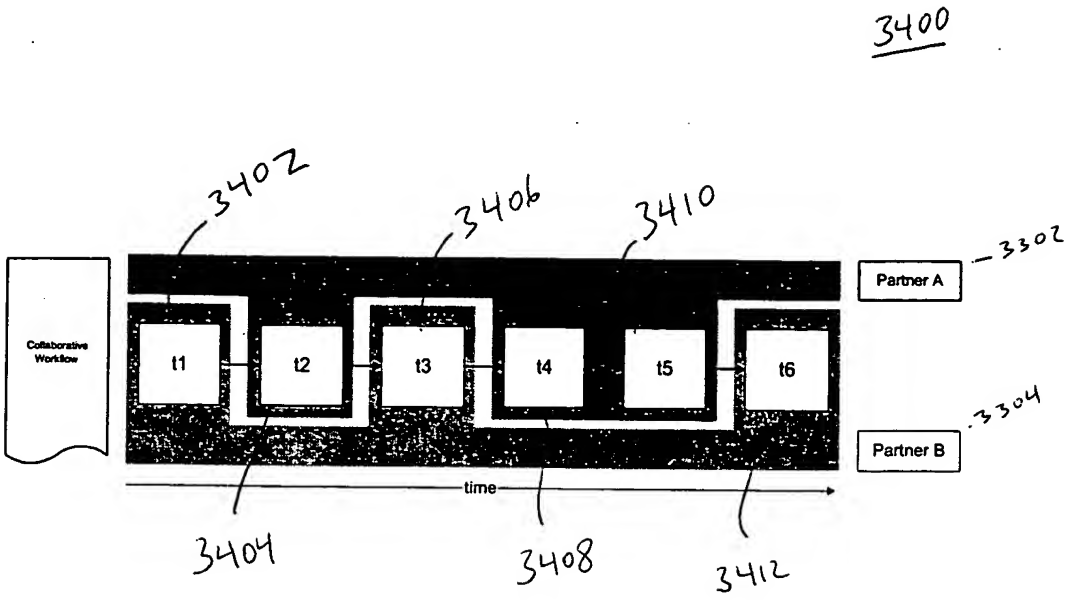

3400
3402
3406
3410
Collaborative Workflow
t1
t2
t3
t4
t5
t6
Partner A
3302
Partner B
3304
time
3404
3408
3412

FIG. 34

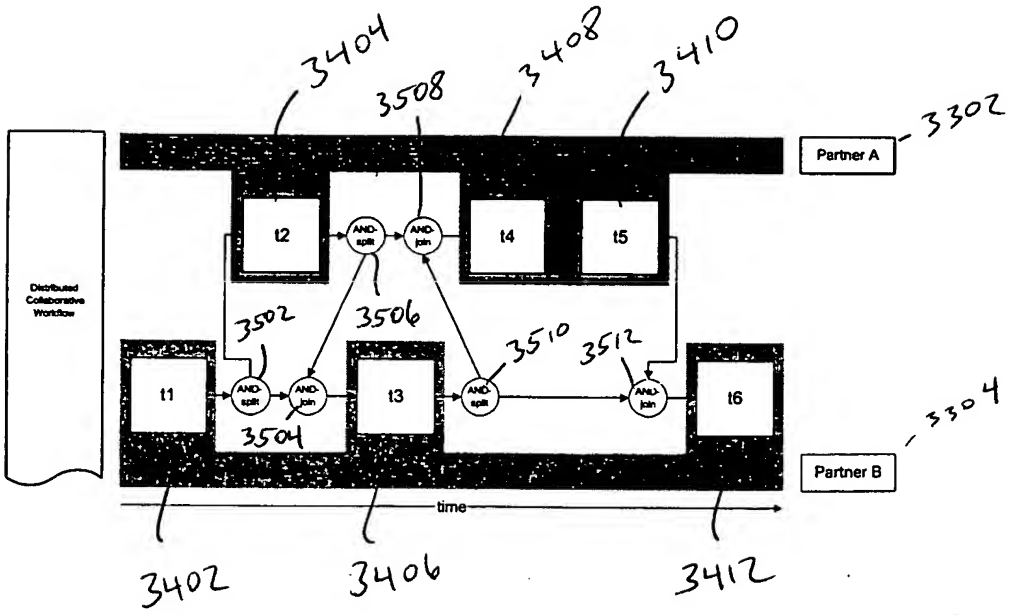

3404
3508
3408
3410
3302
Partner A
t2
AND-split
AND-join
t4
t5
Distributed Collaborative Workflow
3502
3506
3510
3512
t1
AND-split
AND-join
t3
AND-split
AND-join
t6
3504
3304
Partner B
time
3402
3406
3412

FIG. 35

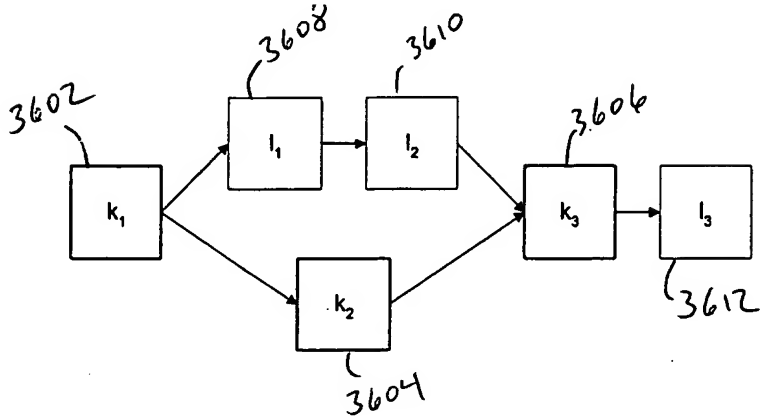


FIG. 36

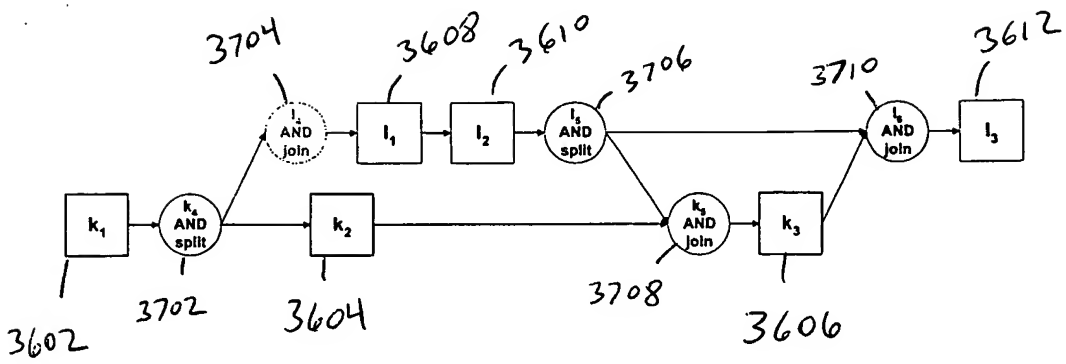

3704
3608
3610
3706
3710
3612
AND join
AND split
AND join
AND split
AND join
k1
k2
k3
l1
l2
l3
3602
3702
3604
3708
3606

FIG. 37

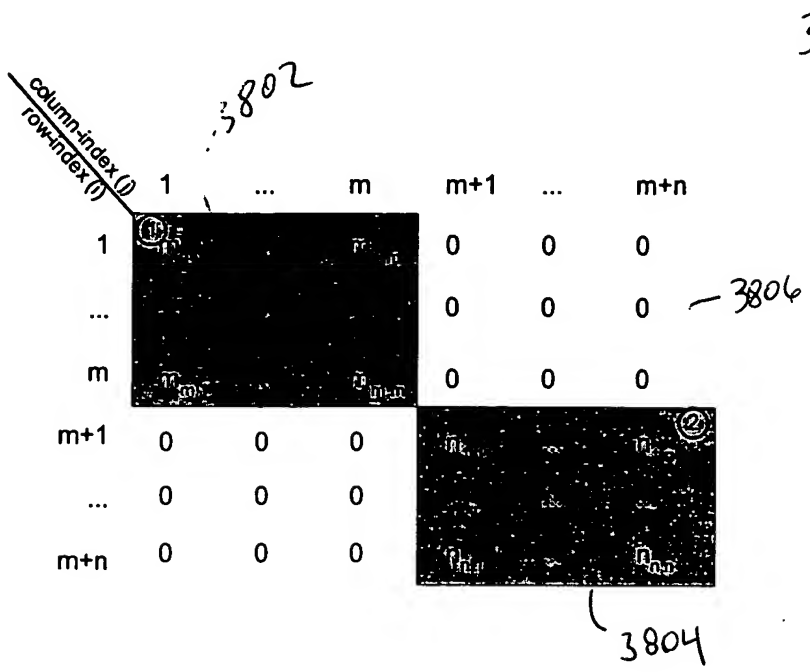

3800
3802
column-index (j)
row-index (i)
1
...
m
m+1
...
m+n
1
...
m
m+1
...
m+n
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
3806
3804

FIG. 38

3900

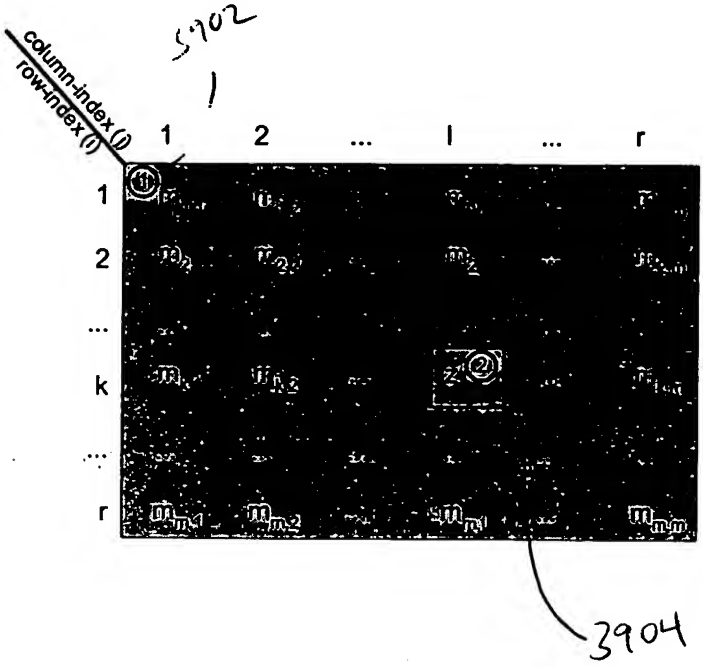


FIG. 39

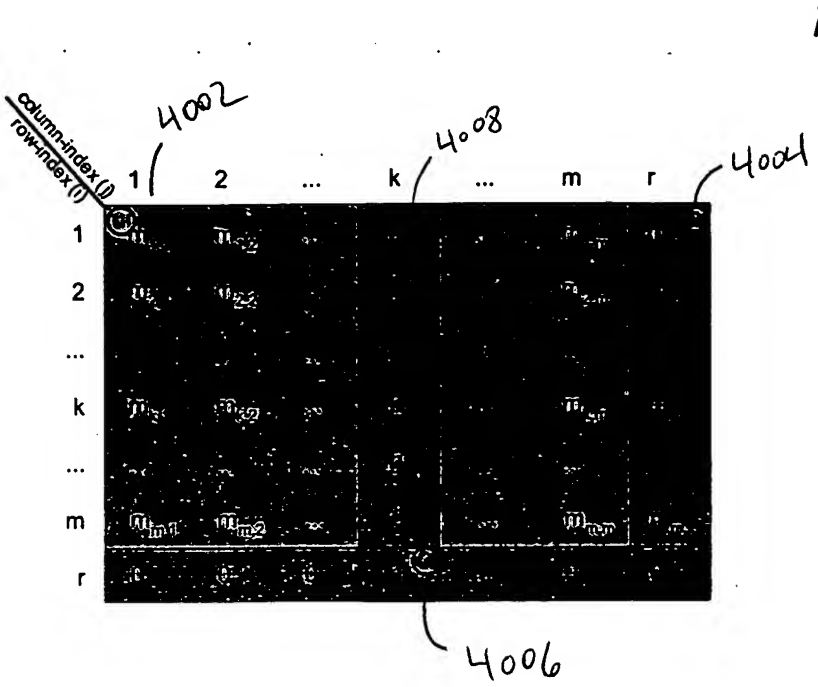


FIG. 40

4100

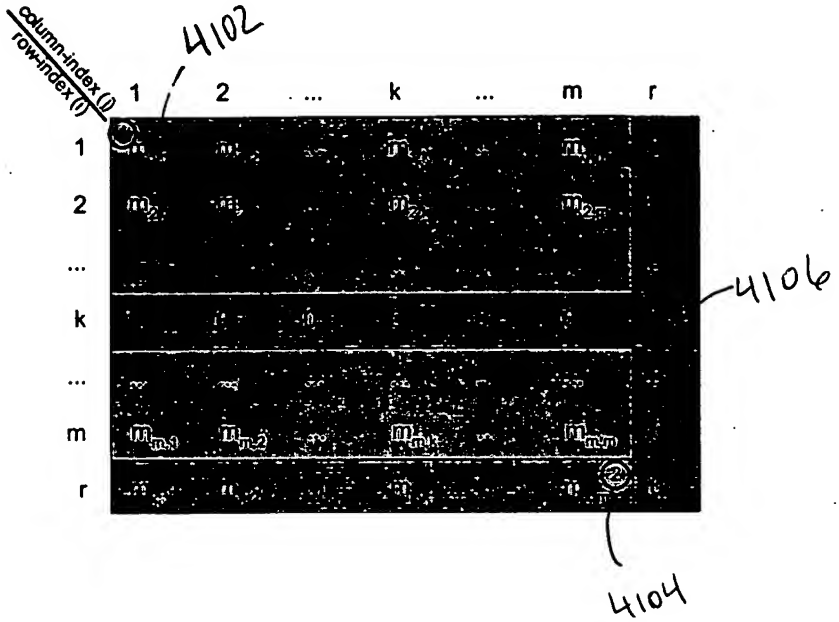


FIG. 41

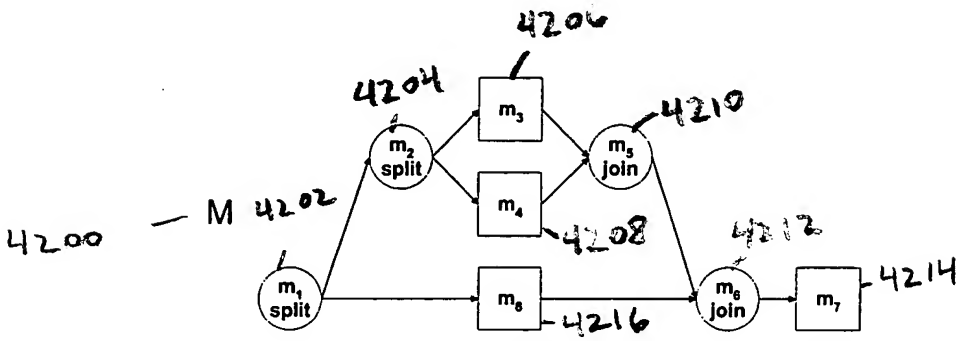


FIG. 42

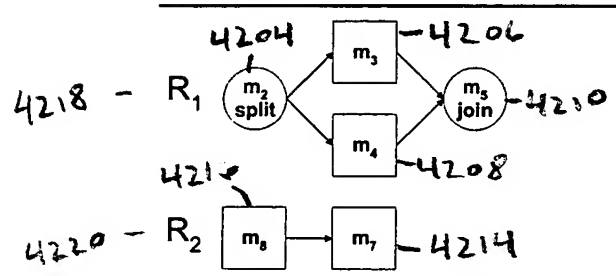


FIG. 42A

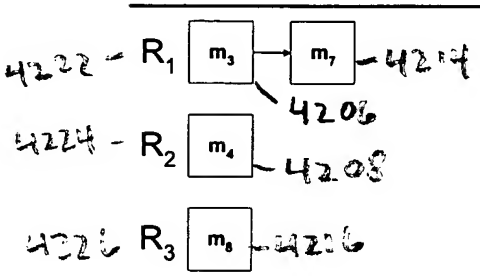


FIG. 42B

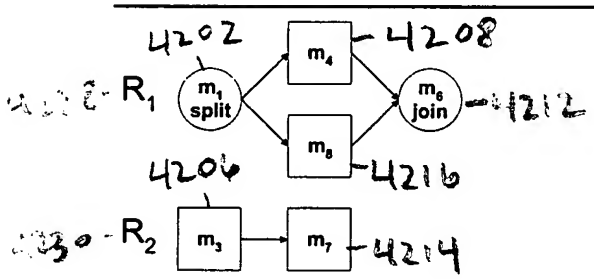


FIG. 42C

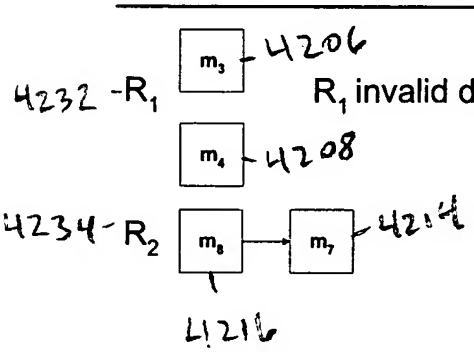


FIG. 42D

4302

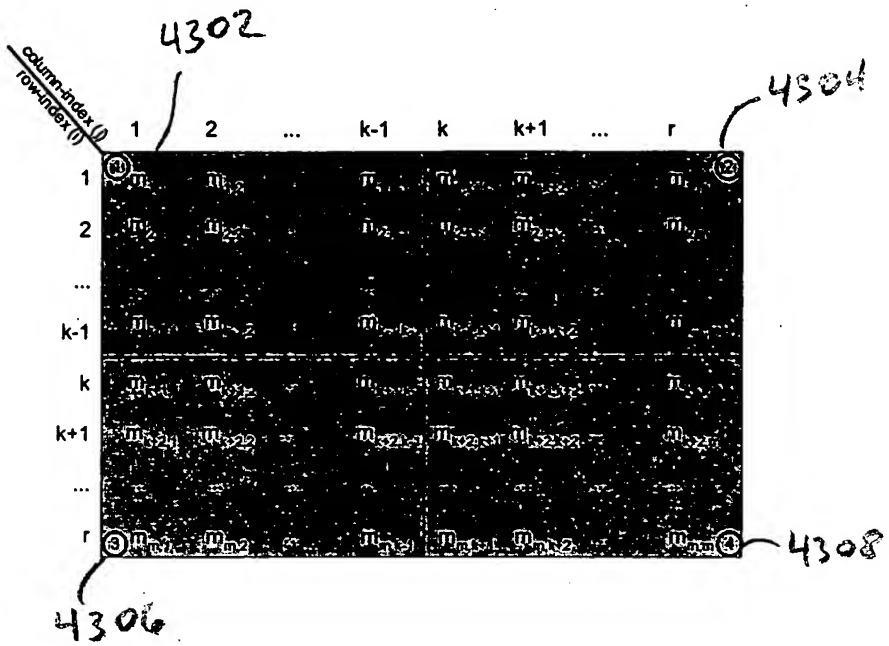


FIG. 43

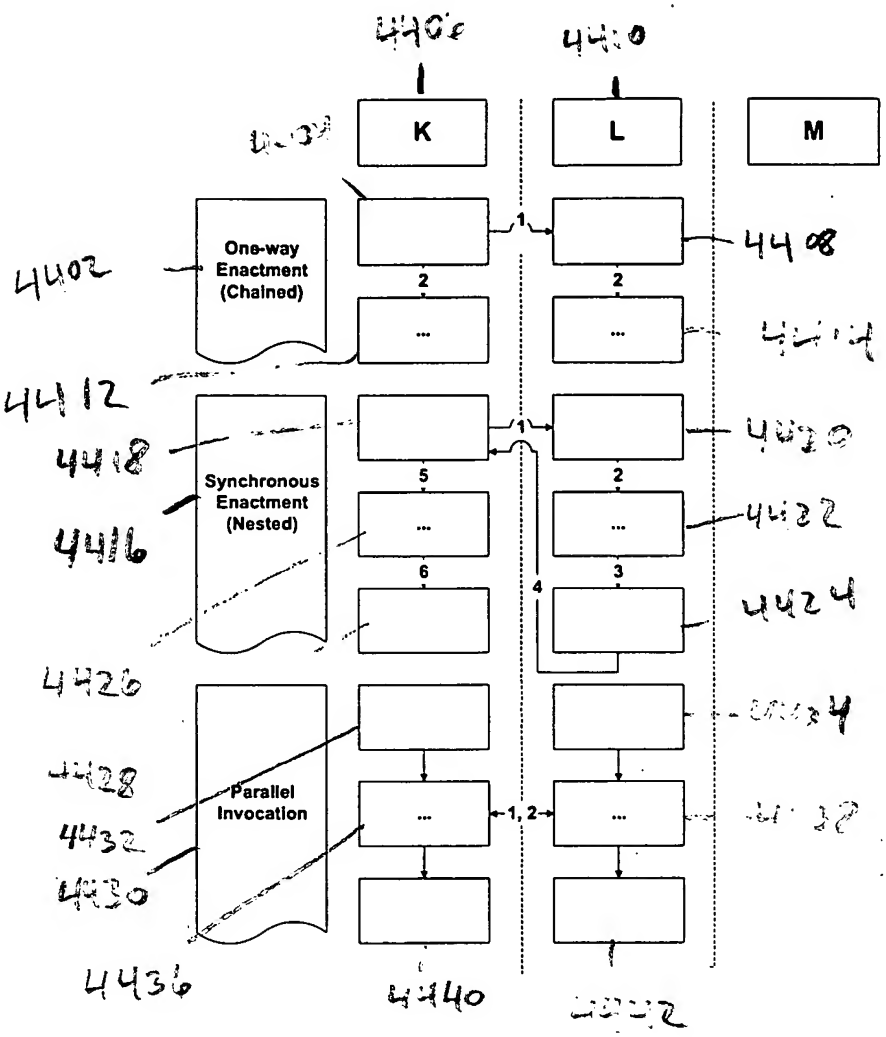

K
L
M
One-way Enactment (Chained)
Synchronous Enactment (Nested)
Parallel Invocation
1
2
...
1
2
5
...
6
1
2
...
3
4
...
1, 2
...

FIG. 44

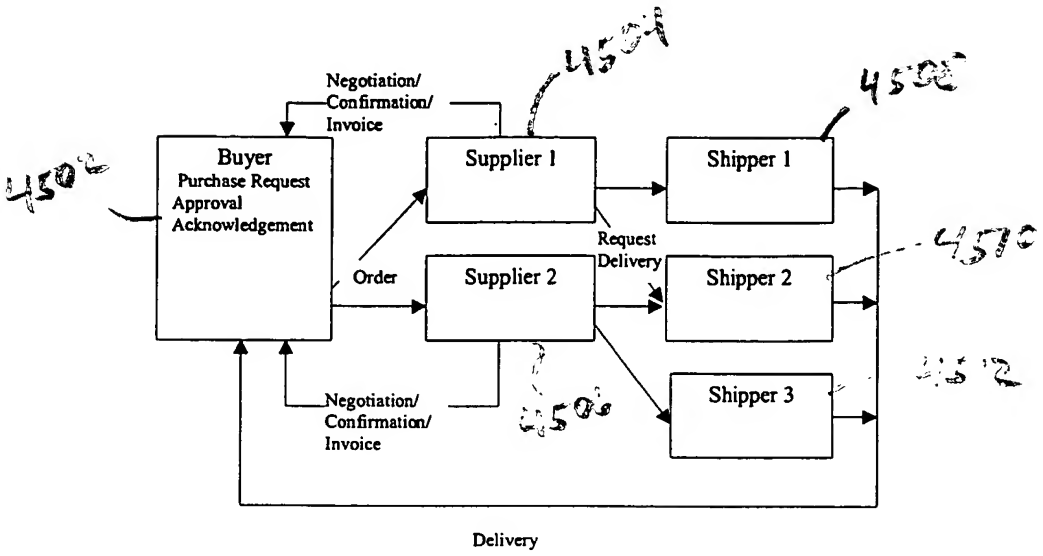

Negotiation/
Confirmation/
Invoice
Buyer
Purchase Request
Approval
Acknowledgement
Supplier 1
Shipper 1
Request
Delivery
Order
Supplier 2
Shipper 2
Shipper 3
Negotiation/
Confirmation/
Invoice
Delivery

FIG. 45

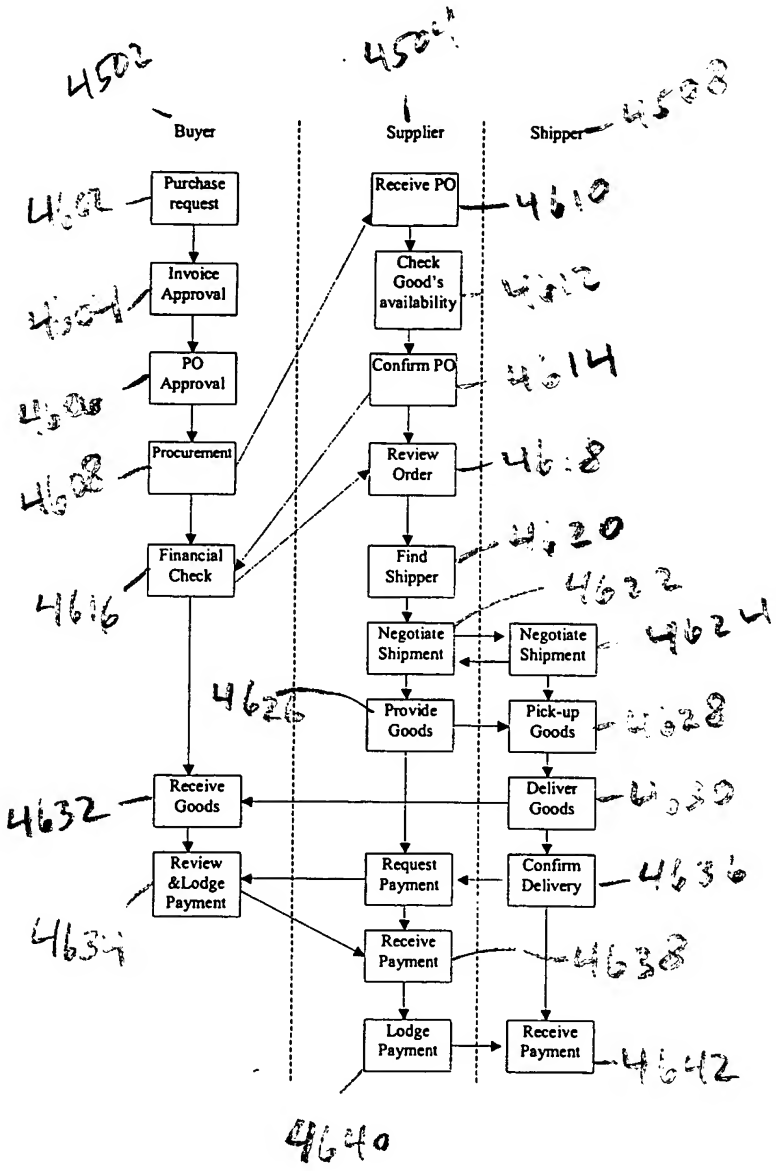

4502
4504
4508
Buyer
Supplier
Shipper
Purchase request
Invoice Approval
PO Approval
Procurement
Financial Check
Receive PO
Check Good's availability
Confirm PO
Review Order
Find Shipper
Negotiate Shipment
Negotiate Shipment
Provide Goods
Pick-up Goods
Receive Goods
Deliver Goods
Review &Lodge Payment
Request Payment
Confirm Delivery
Receive Payment
Lodge Payment
Receive Payment
4610
4614
4618
4620
4622
4624
4626
4628
4630
4632
4634
4636
4638
4642
4640

FIG. 46

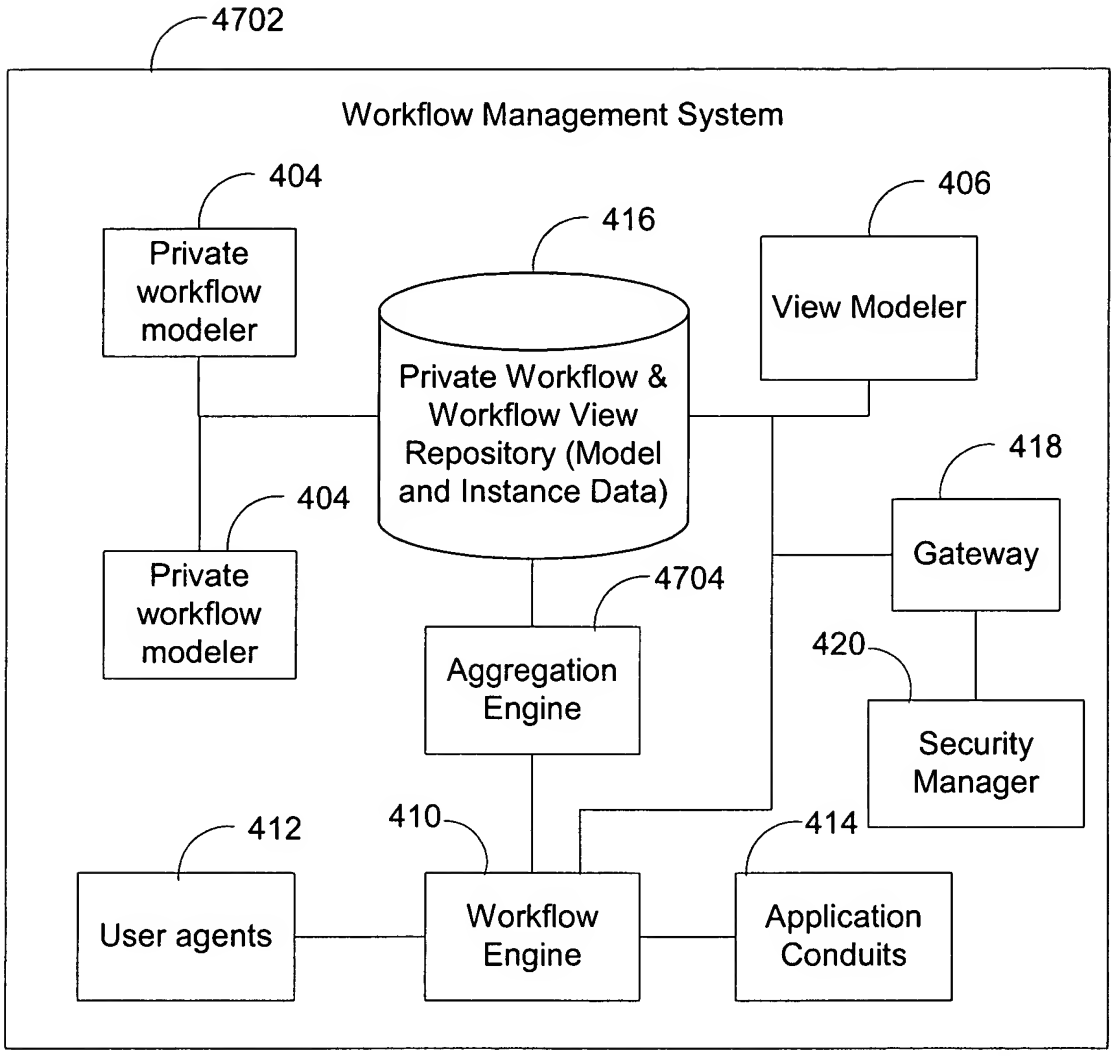

4702
Workflow Management System
404
Private workflow modeler
416
Private Workflow & Workflow View Repository (Model and Instance Data)
406
View Modeler
404
Private workflow modeler
418
Gateway
4704
Aggregation Engine
420
Security Manager
412
User agents
410
Workflow Engine
414
Application Conduits

FIG. 47

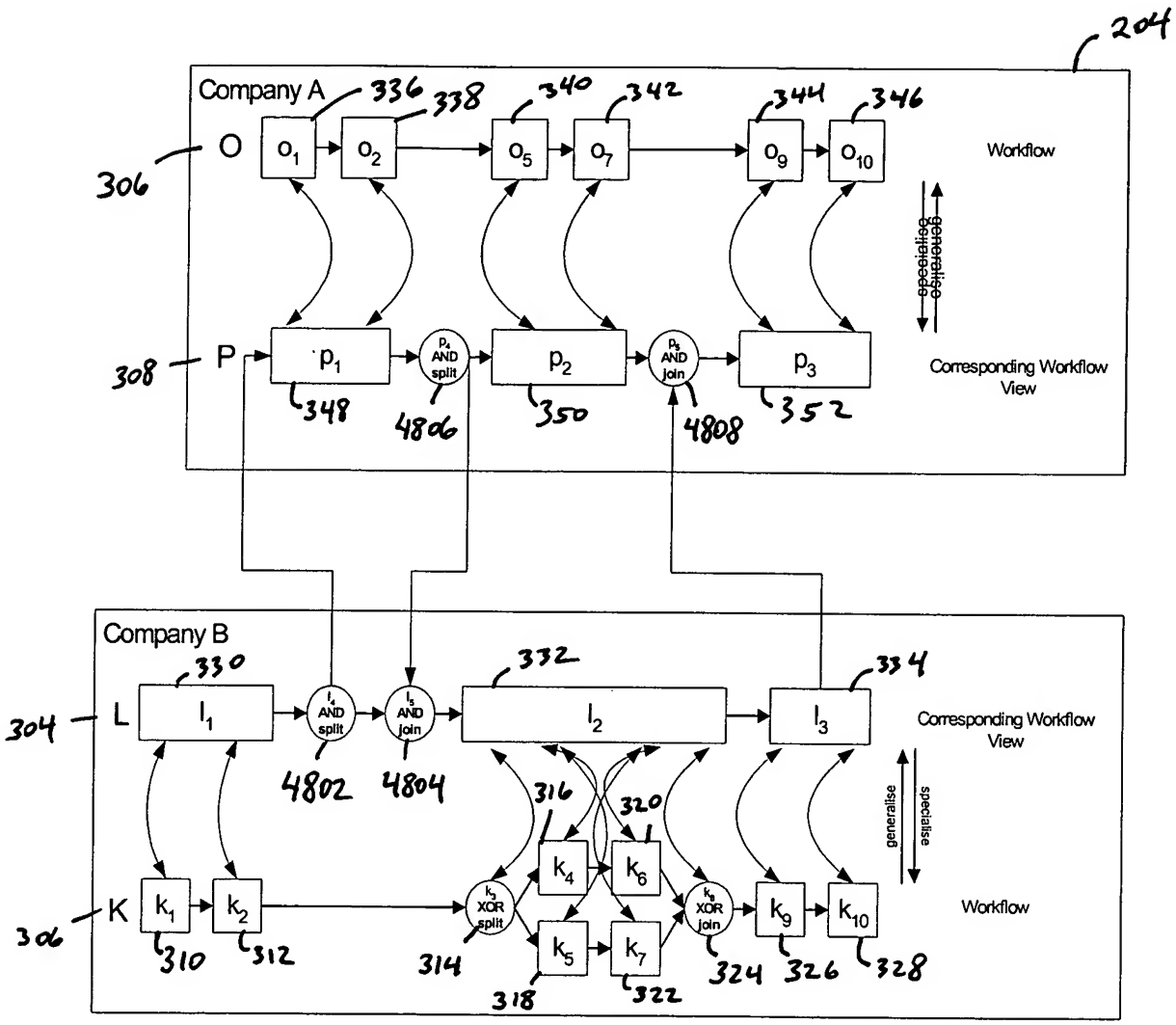

204
Company A
336
338
340
342
344
346
O
306
o_1
o_2
o_5
o_7
o_9
o_{10}
Workflow
generalise
specialise
P
308
p_1
p_4 AND split
p_2
p_5 AND join
p_3
348
4806
350
4808
352
Corresponding Workflow View
Company B
330
332
334
L
304
l_1
l_4 AND split
l_5 AND join
l_2
l_3
4802
4804
Corresponding Workflow View
316
320
K
306
k_1
k_2
k_3 XOR split
k_4
k_6
k_5
k_7
k_8 XOR join
k_9
k_{10}
Workflow
310
312
314
318
322
324
326
328

FIG. 48

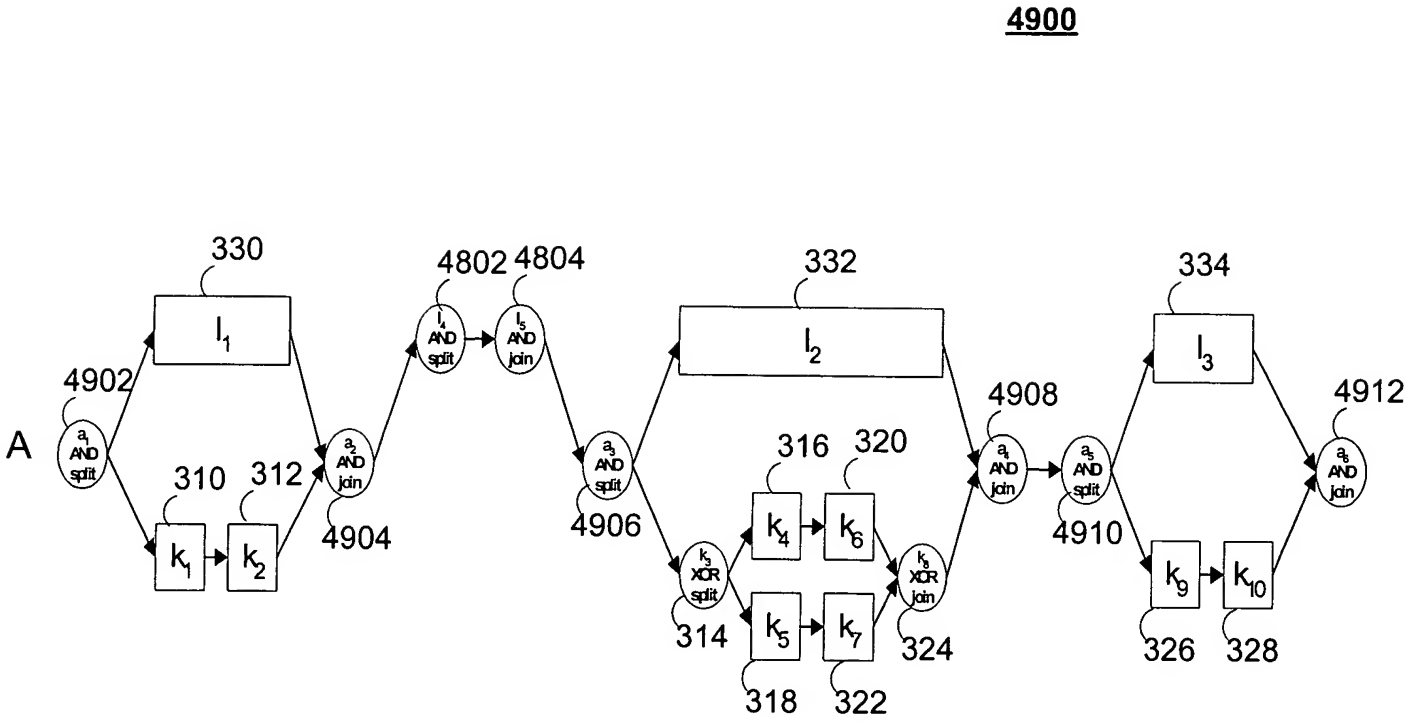

4900
A
330
4902
a_1 AND split
l_1
310
312
k_1
k_2
a_2 AND join
4904
4802
4804
l_4 AND split
l_5 AND join
a_3 AND split
4906
332
l_2
k_3 XOR split
314
316
320
k_4
k_6
k_5
k_7
318
322
k_8 XOR join
324
4908
a_4 AND join
a_5 AND split
4910
334
l_3
k_9
k_{10}
326
328
4912
a_6 AND join

FIG. 49

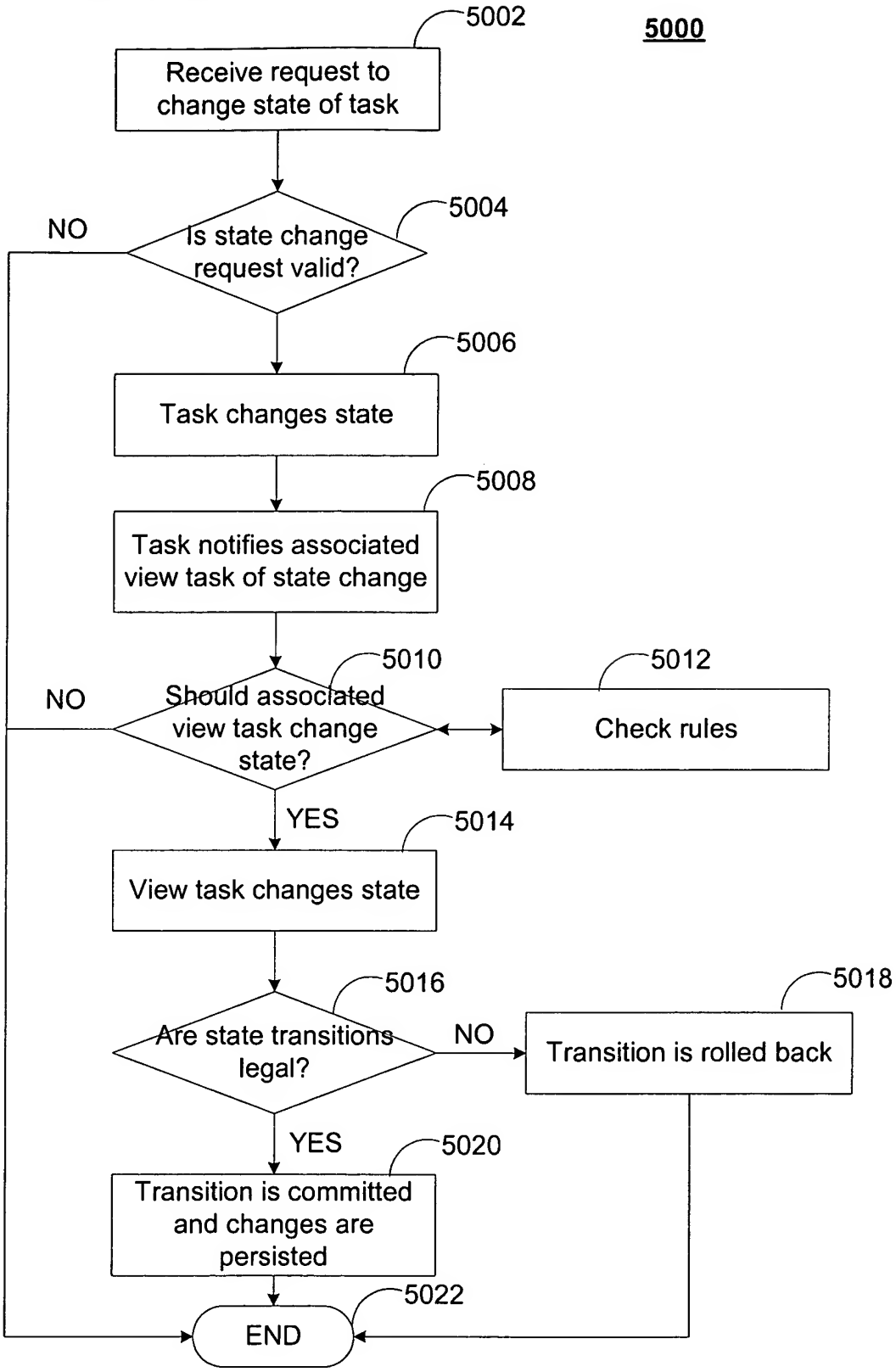

5000
5002
Receive request to change state of task
5004
Is state change request valid?
NO
5006
Task changes state
5008
Task notifies associated view task of state change
5010
Should associated view task change state?
NO
5012
Check rules
YES
5014
View task changes state
5016
Are state transitions legal?
NO
5018
Transition is rolled back
YES
5020
Transition is committed and changes are persisted
5022
END

FIG. 50

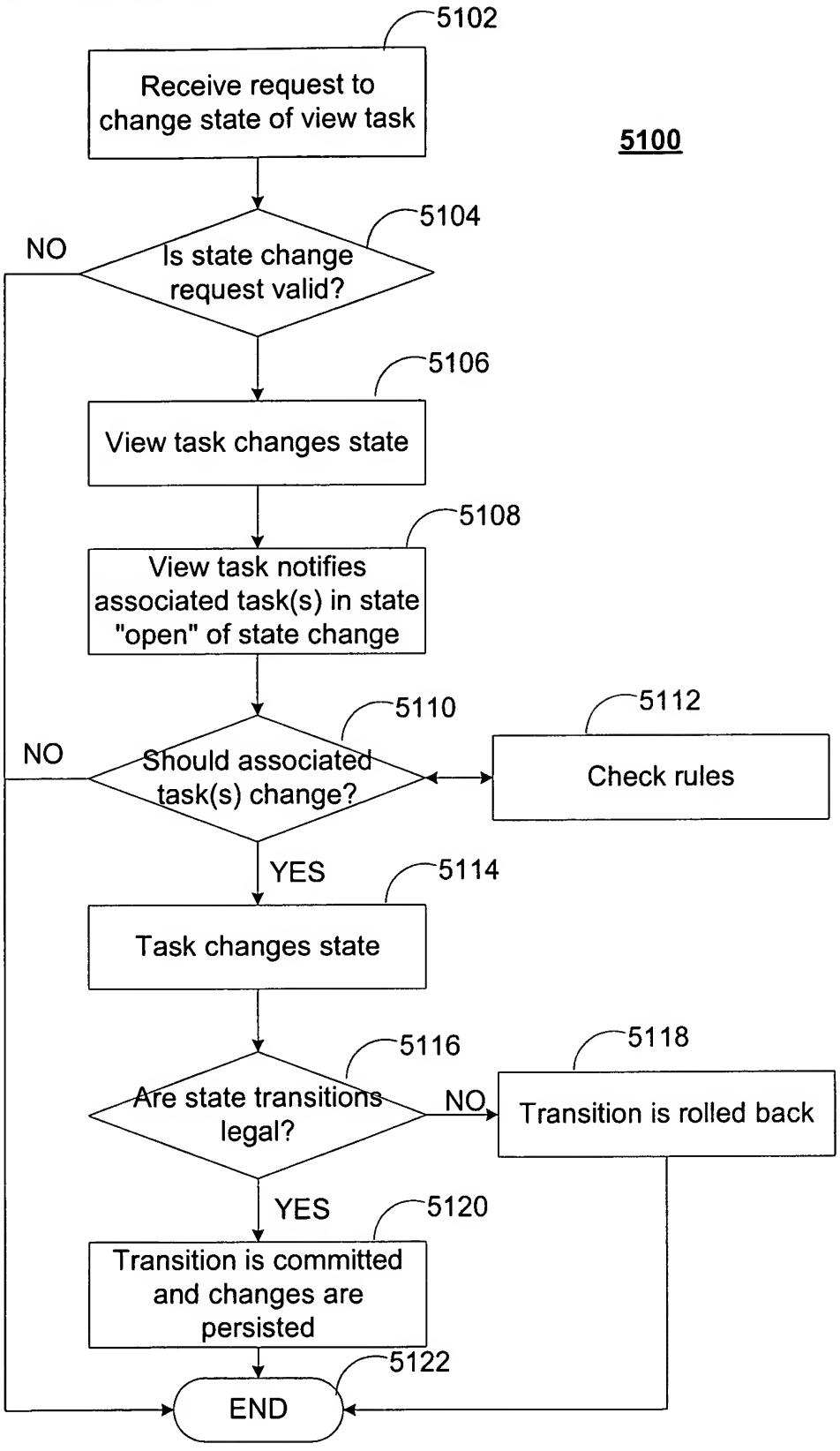

5102
Receive request to change state of view task
5100
5104
NO
Is state change request valid?
5106
View task changes state
5108
View task notifies associated task(s) in state "open" of state change
5110
5112
NO
Should associated task(s) change?
Check rules
YES
5114
Task changes state
5116
5118
Are state transitions legal?
NO
Transition is rolled back
YES
5120
Transition is committed and changes are persisted
5122
END

FIG. 51

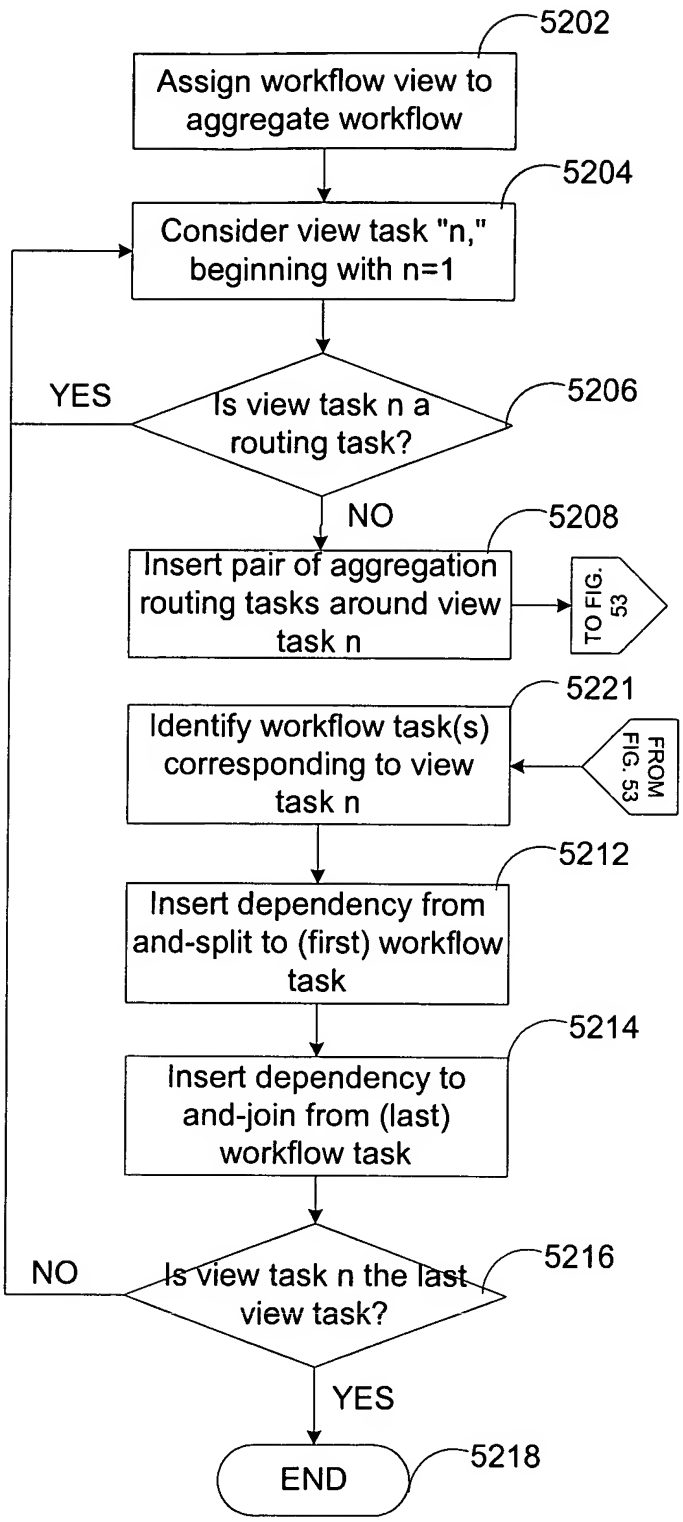

5200
5202
Assign workflow view to aggregate workflow
5204
Consider view task "n," beginning with n=1
YES
Is view task n a routing task?
5206
NO
5208
Insert pair of aggregation routing tasks around view task n
TO FIG. 53
5221
Identify workflow task(s) corresponding to view task n
FROM FIG. 53
5212
Insert dependency from and-split to (first) workflow task
5214
Insert dependency to and-join from (last) workflow task
NO
Is view task n the last view task?
5216
YES
END
5218

FIG. 52

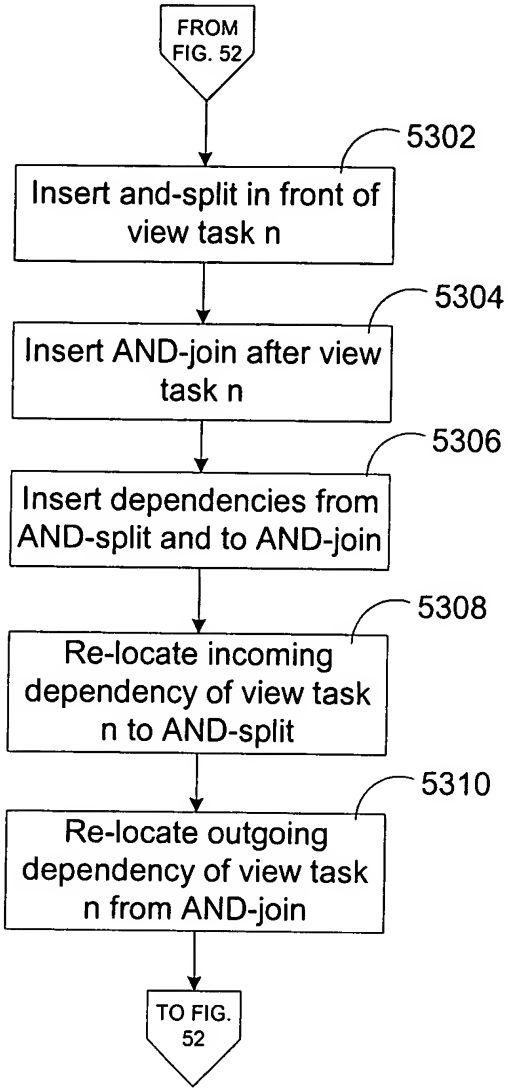

FROM FIG. 52
5300
5302
Insert and-split in front of view task n
5304
Insert AND-join after view task n
5306
Insert dependencies from AND-split and to AND-join
5308
Re-locate incoming dependency of view task n to AND-split
5310
Re-locate outgoing dependency of view task n from AND-join
TO FIG. 52

FIG. 53